The Chemical Industry:

Viewpoints and Perspectives

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Conrad Berenson

Assistant Professor of Business Administration
Bernard M. Baruch School of Business
and Public Administration
The City College of The City University of New York

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Preface

The principal problems of the chemical process industries are in the areas of marketing and management. This is reflected, for example, in the fact that during the last ten years the industries' chemical segment has been operating at a rate of approximately 80 per cent of capacity. Some of this excess capacity is due to the fact that economically optimum plant sizes may, at times, exceed the market demand for the plant's products. A great deal more of the excess capacity, however, can be traced to severe competition in the chemical process industries and to a less than adequate knowledge of the business and the variables affecting it. Because of these and other factors the industries' profits have declined significantly during this period.

It is the purpose of this book to provide insights into the commercial activities of the chemical process industries so that those who work in and with these industries can operate more effectively to solve their business problems. The approach taken in providing these insights is to present a collection of case studies, articles, reports, and other materials which describe the experiences of existing CPI (chemical process industries) firms. Thus in each selection the actual operating experience of a CPI firm is presented with a brief editorial introduction and commentary which places the particular example in its proper context and perspective.

This is the first time that a book of this kind has been written for the chemical industry. Ordinarily, the books seeking to set forth the commercial background of an industry are oriented toward the presentation of a set of basic principles that govern the industry's behavior; for example, my own recent book on the chemical process industries, *Administration of the Chemical Enterprise*. However, it is not sufficient merely to set these principles down and abandon the reader to integrating them into a perspective that is useful. Educators have found that the process of integrating principles into a useful overview is so difficult that it is an enormous aid to provide records of actual experiences, with materials that illustrate the application of the basic principles. Casebooks, although unique to the CPI, are a well-established educational tool in other fields. They have been found, for example, to be indispensable to the successful teaching of subjects such as marketing, management, and finance.

Forty-seven selections have been chosen for this book and have been divided into four major sections, each of which contains an introduction that will serve to orient the reader to the particular commercial area of the CPI then under consideration. The individual items have been selected for their ability to illustrate an important problem or subject; however, they are *illustrative only,* and *not definitive.* In a book that, necessarily, deals with so many phases of the commercial aspects of the CPI, it is not feasible to present comprehensive coverage of the various points.

The dates of original publication of the selections are all relatively recent. However, the dates themselves are not significant; rather it is the selections' ability to illustrate a subject well and to deal with major concepts and trends that is most important. These concepts and trends are ordinarily quite slow to change and should serve a useful illustrative purpose for some time to come. Even though the selections deal with a specific subject via reference to the experience of a particular CPI firm, it is the experience that is important to note. In other words, in the article that relates why Monsanto eliminated a product from its line it is not the fact that it was Monsanto that made the selection valuable but the principles and policies illustrated by Monsanto's actions. These principles and policies, if properly studied, can serve as valuable guidelines to managers in other CPI firms who may be faced with similar decisions.

This book has been designed to serve as a useful tool to those already employed in the chemical process industries, to those who deal with these industries and want a better understanding of its philosophies and practices, to senior students who *must* understand the nontechnical dimensions of the profession for which they are studying (they will find it hard to function effectively on a technical level if they do not), and to all those interested in achieving an understanding of the commercial structure of one of the nation's major industries.

I am indebted to all of the authors, editors, and publishers who gave permission to reprint materials used in this book.

CONRAD BERENSON

Brooklyn, N. Y.
August 1963

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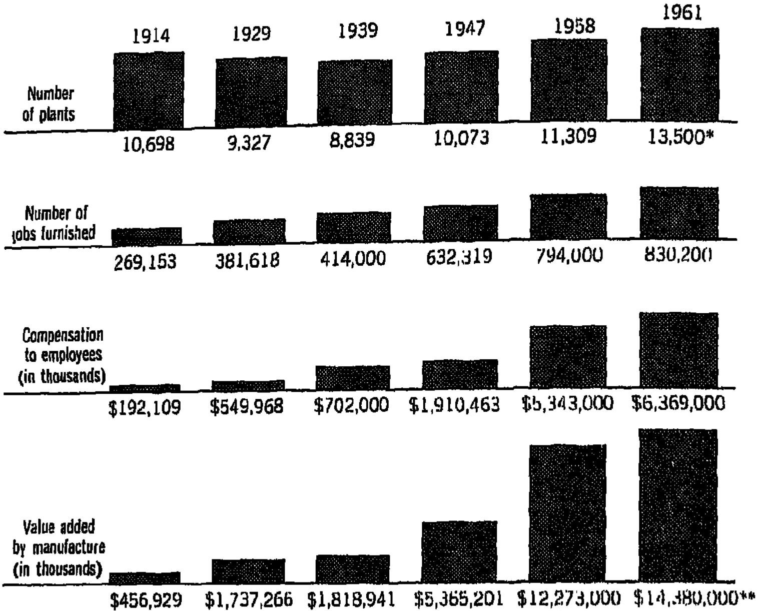
Part One

The Background of the Chemical Industry

Size and Scope

In 1962 the chemical industry's sales were 32.5 billion dollars; this total makes the chemical industry the fifth largest in the United States in terms of sales. At the same time the assets of the chemical industry were 26 billion dollars, placing the industry in fourth position among all those in the nation. Since 1959, chemical sales have attained a compound annual growth rate of 8.3 per cent; this is substantially greater than the percentage gain in the United States' gross national product. The chemical industry then is big by any standard and is getting bigger.

The importance of the industry is further illustrated by Figure 1, which is a composite of a variety of government statistics. The industry's growth in the past few years has stemmed largely from the product areas such as plastics and resins, detergents, man-made fibers, synthetic rubber and agricultural chemicals.



*MCA Information Service estimate.
**1960 data latest available.

Figure 1. Chemicals and allied products growth. (Source: U. S. Department of Commerce, Bureau of the Census.)

The relationship of the chemical industry to the economy may be described in several ways. In the first, we can examine the total compensation paid to the industry's employees and relate this figure to the sum paid to the employees of all manufacturing industry. Utilizing the 1961 figures of the United States Department of Commerce (these are the most recent data) the total compensation of the chemical industry's employees was 6.6 per cent of the compensation paid to all industrial employees, i.e., $6.4 billion/$87.8 billion.

Another way of gauging the industry's relation to the economy is to examine its assets position; in 1961 the assets, placing the industry fourth in the nation, amounted to 8.7 per cent of the assets of all manufacturing corporations. Still another way of looking at the chemical industry is to examine the sum that it spends on new plant and equipment. In 1961 this amounted to 1.6 billion dollars, or 11.6 per cent of all new plant and equipment expenditures by the nation's 15 major manufacturing industries. That this is not an unusually high level of expenditure for the industry is indicated by the fact that, for the ten-year period 1952–1961, the industry accounted for 10.8 per cent of all expenditures for new plant and equipment. In terms of power consumption, tank car revenue, federal income tax payments, etc., the chemical industry remains as a major contributor to the economy.

A great many chemists and chemical engineers are employed outside of the narrow industrial branch termed *chemicals and allied products*; this branch's activities are the basis for all of the above data. In larger perspective, many of those with chemical training and interests are employed in the group of industries which is called the *chemical process industries*. The latter group comprises those enterprises which employ chemical change at one or more stages of their manufacturing activity. As such, they are differentiated from the purely mechanical industries which merely change the shape and size of materials and assemble them into marketable products. Examples of chemical process industries are, in addition to the chemical and allied products group, the paper and allied products, petroleum, coal products, clay and glass, rubber and plastics industries, etc. The importance of these industries to the nation can be deduced from Table I, which lists the total assets and total sales for the 18 leading manufacturing industries. (It should be noted that these data differ from those previously presented; such data are obtained from various government agencies and each agency uses a different basis for computation.)

Economic Characteristics

There are more than 10,000 chemical products produced and sold commercially by over 13,500 plants in the United States. These plants each utilize the inputs of personnel, technology, capital and raw materials to derive a business system which attempts to optimize the firm's output. Despite the tremendous number of possible combinations of these inputs, the business systems which result (i.e., the firms) have a number of common characteristics which serve to set them apart from companies in other branches of industry. Several of these characteristics are briefly outlined below.

Intense competition

The chemical industry is extremely competitive. This stems from the fact that many of these 10,000 commercial chemical products can be made from different raw materials and by alternate processes. The

Table 1 *Rank of Chemical Industry among Some Manufacturing Industries**

In Terms of Total Assets as of Dec. 31, 1961		*In Terms of Total Sales for the Year 1961*	
	(in millions)		*(in millions)*
1. Petroleum refining and related industries	$42,195	1. Food and kindred products	$57,119
2. Primary metal industries	30,186	2. Transportation equipment	43,961
3. Transportation equipment	29,936	3. Petroleum refining and related industries	30,837
4. *Chemicals and allied products*	25,899	4. Electrical machinery, equipment and supplies	29,634
5. Food and kindred products	24,879	5. *Chemicals and allied products*	27,824
6. Machinery other than electrical	21,470	6. Primary metal industries	26,672
7. Electrical machinery, equipment and supplies	19,515	7. Machinery other than electrical	25,729
8. Fabricated metal products other than machinery	11,506	8. Fabricated metal products other than machinery	17,938
9. Paper and allied products	11,051	9. Textile-mill products	13,398
10. Stone, clay and glass	8,834	10. Paper and allied products	12,525
11. Textile-mill products	8,456	11. Apparel and other finished products	12,365
12. Rubber and miscellaneous plastics products	5,852	12. Stone, clay and glass	9,310
13. Printing and publishing except newspaper	5,730	13. Printing and publishing except newspaper	9,056
14. Apparel and other finished products	4,684	14. Rubber and miscellaneous plastics products	8,505
15. Lumber and wood products except furniture	4,626	15. Miscellaneous manufacturing and ordnance	5,975
16. Instruments and related products	4,525	16. Lumber and wood products except furniture	5,886
17. Miscellaneous manufacturing and ordnance	4,121	17. Instruments and related products	5,660
18. Tobacco manufactures	3,712	18. Tobacco manufactures	5,300

*Estimates in this table differ from data published by the U. S. Department of Commerce.

Sources: *Federal Trade Commission; Securities and Exchange Commission.*

number of technically qualified personnel is relatively high, so that technological progress by one firm is ordinarily quickly countered by the advances of its competitors.

There is competition among different products for satisfying the same end-use demand. Thus, if one is seeking a thermoplastic material, there is a choice of polyethylene, polypropylene, polystyrene, etc.; each of these is available in many molecular weight and quality ranges (over 100 for some polyethylene producers, for example); further, the monomers of these polymers are available as copolymers with a large number of other monomers. In addition, for a great many end uses there are entirely different products which will satisfy the demand, e.g., polyethylene film, aluminum foil and wax paper all satisfy a demand for a flexible wrapping material.

Freedom of market entry

The chemical industry is one which can be entered easily by those with sufficient capital to purchase technology. The multitude of products, processes and raw materials which can substitute for each other, together with the availability of trained manpower and the large number of expertly qualified vendors of processes and plants, makes it relatively easy to enter the chemical industry.

Price stability

As a result of the intense competition in the chemical industry and the freedom of market entry, prices have been extremely stable. The 1961 wholesale price index of chemicals and allied products was 1 per cent lower than that for 1951; during this same period all commodities except farm and food rose 10 per cent.

This price stability is also due to the large sums spent by chemical firms on research. It is not unusual for a chemical firm to spend an amount equal to 4 to 5 per cent of its sales volume upon research and development. For 1961, these R&D expenditures amounted to 1.1 billion dollars; this indicates an "average" R&D expenditure of 3.7 per cent of sales. The "average" is lowered by the many products which are in a mature phase (sulfuric acid, sodium hydroxide, etc.) and upon which relatively little research funds are expended. One result of these enormous R&D expenditures is that the existing products can be made with greater efficiency. Another result is that, faced by new products of improved utility (50 per cent of the chemical products manufactured today were unknown 15 years ago) manufacturers accept a lower rate of return on the old products in order to remain competitive.

Finally, prices have remained stable or even declined despite rising costs simply as a defensive maneuver by existing chemical firms. The belief of these companies is that this approach is best to discourage other firms from entering the chemical industry or a phase of the chemical industry. Since maintenance of traditional price levels has, in many cases, resulted in lower profits, this strategy has been frequently successful.

High capital investment

The capital investment of the chemical industry (per employee) is among the highest in the nation; this can be seen in Table II. The high investment is due to both high equipment costs and the high minimum plant capacity necessary before break-even points can be reached.

Table 2 Capital Investment per Employee for Some Manufacturing Industries*

Industry	*As of 1959*
Petroleum	$62,790
Tobacco	33,920
Chemicals and allied products	22,683
Primary metal industries	19,033
Motor vehicles and equipment	17,090
Food and kindred products	11,535
Transportation equipment	10,515
Electrical machinery and equipment	9,052
Fabricated metal products	8,687
Textile-mill products	8,524

*Capital invested represents total assets less investments in Government obligations and other securities.

Source: MCA Information Service.

Summary

The previous pages have presented some of the background material which illustrates the scope and definitive characteristics of the chemical industry. The three selections which follow provide additional information along these lines.

The chemical industry can be distinguished from other industries by a number of characteristics. Recognition of these differences is important to a full understanding of specific business problems that might be faced by individuals or firms within the CPI (Chemical Process Industries). In this article, the author, who is president of a large chemical manufacturing enterprise (107 million dollars in sales in 1962), outlines a few of these distinguishing elements, e.g., technical complexity, intense competition, rapid obsolescence of facilities, and the relative stability of prices.

1 What Is So Different about the Chemical Industry?

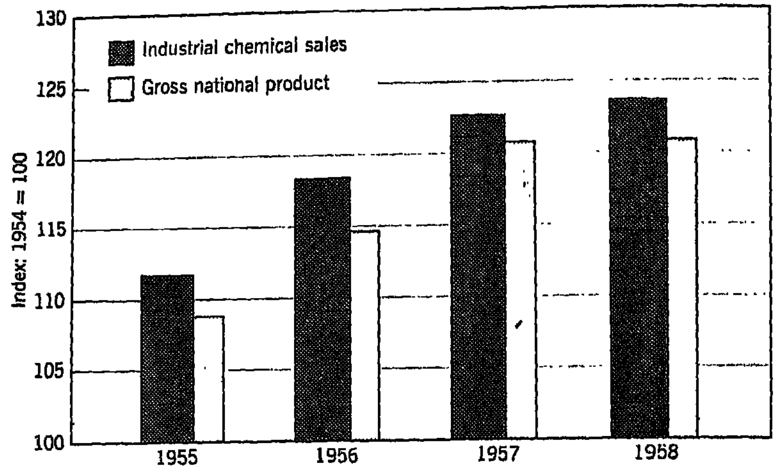
by Robert B. Semple

The chemical industry has grown from a comparatively small but prosperous industry at the turn of the century to where it is now, based on total assets at June 30, 1959, the fourth-largest manufacturing industry. In terms of total sales for the first half of 1959, the chemical industry ranks fifth among all manufacturing industries. Our industry is important not only as a supplier to producers, who in turn serve other industries, but also as a consumer of many types of goods and services, and as a major employer and a taxpayer. These contributions to the economy by the chemical industry are not localized. There are approximately 12,500 chemical plants, which are located in all 50 states.

A comparison of the growth of industrial chemical sales to the growth of Gross National Product for the years 1955 through 1958 is illustrated on Chart I. The classification, industrial chemicals, includes most of the heavy chemicals and other bulk chemicals sold chiefly to other industries.

Reprinted with permission from *The Commercial and Financial Chronicle*, Vol. 190, No. 5902 (November 26, 1959), p. 18. This was originally presented by Mr. Semple before the 28th Mid-Continent Trust Conference of the American Bankers Association, Detroit, Michigan, Nov. 5, 1959. Mr. Semple is president of the Wyandotte Chemicals Corporation.

Chart I. Index of growth—industrial chemical sales and gross national product. (Sources: The Conference Board; Department of Commerce.)



Industrial chemical sales, as a per cent of 1954 sales, exceed Gross National Product as a per cent of the base year by 2 to 4%. Dollar-wise, sales have increased from approximately $13.7 billion in 1947 to $23.5 billion in 1958.

Characteristics of the Chemical Industry

The chemical industry has certain distinct characteristics of which the most obvious one is its complexity. Some industries start with a number of raw and semifinished materials to make a single product, like an automobile; others take a single raw material like petroleum and make a number of end products from it. The basic raw material of the chemical industry is the molecule. This tremendous scope enables the industry to produce more than 10,000 distinct chemical entities to which hundreds more are added annually.

Because of this complexity, the industry has developed various other characteristics, which distinguish it from other industries.

We all know that competition is the lifeblood of the American economy, but in the chemical industry it reaches a unique intensity. In 1958, for example, the combined sales of the three largest chemical companies amounted to less than 16% of total chemical industry sales. This intensity, as well as the growth of industry competition, is best reflected perhaps by the number of producers competing in certain fields; for example, ammonia producers number 12 in 1949, 40 in 1959. There are now approximately 230 producers of plastics material, 84 for sulfuric acid, 160 for organic intermediates, 54 for dyes, and 1,429 for paints.

Another distinguishing characteristic of the industry is the intercommodity competition. Many chemicals compete with each other. Chlorine is a good example in that it is used as an oxidizing agent, as a bleaching agent for textiles and paper, and as a bactericide for water purification. It competes with other oxidizing agents in bleaches, such as hydrogen peroxide, and bactericides, such as ammonia compounds. There are numerous examples of various chemicals which may perform the same functions.

Interprocess competition, I believe, is peculiar to the chemical industry; for example ethylene glycol is made by four different processes; phenol and vinyl chloride, each by three different processes.

There is also inter-end product competition. An example of this is cellophane versus wax paper, versus aluminum foil, versus polyethylene film, versus acetate film. All compete in the packaging or the wrapping field.

Lastly, there is the interindustry competition. In the past years, there has been a marked increase in the number of companies not primarily involved in chemical production that have entered the chemical field and are capturing sizable portions of markets for particular products. Included are leaders in electrical equipment, food, metal, shipping, rubber, distilling, paper, photography, and virtually all of the petroleum producers.

There are 5 basic reasons for this intense competition: (1) most chemicals regularly produced in the U.S. can be made by different processes from alternate raw materials; (2) existing producers do not have market dominance; (3) patent monopolies of great importance are few and far between; (4) research progress affords a company the advantage of a product or process for only a limited time; and (5) foreign competition is increasing. This foreign competition is secondary in nature in that it is our customers, who are faced with direct product competition.

Another economic characteristic of the chemical industry is the rapid obsolescence of facilities.

A constant development of new products and new processes causes chemical industry equipment to become obsolete even before it has paid for itself. In addition, equipment depreciation is accelerated by the severe conditions under which it is operated; conditions such as corrosion, high temperatures and pressures, along with constant efforts to maintain the highest possible levels of safety often cause equipment to be discarded before it is obsolete.

Another economic characteristic of the industry is relative stability of our selling prices. The tremendous variety of applications of chemicals and the number of companies requiring chemicals for manufacturing operations tend to insure a fairly level demand for bulk chemicals even in recession periods. These factors, in addition to a high rate of production made possible by well-designed plants and the healthy pressure of competition, hold prices to relatively low levels or increase at a slower rate than the average for all manufactured prices. Because of these stable prices, the chemical industry has been caught in somewhat of a price squeeze. Such items as chemical wages, freight rates, and the cost of machinery have increased approximately 25% to 50% more than the selling prices of chemicals.

A comparison of the chemical to the iron and steel industry illustrates dramatically the lag of price increases which has existed in the chemical industry. The selling price in the iron and steel industry have increased to approximately 172% of the 1947–1949 base period, which approximates the chemical wages increase of 176% in the same period. We could not, however, pass this latter increase on to our customers. While the iron and steel industry increased their prices approximately 40% of the base-period price during the period 1953–1958, chemical prices rose approximately 5%.

Because of this price squeeze in the chemical industry, further competition is created and in turn accentuates the price squeeze. Let me explain this cycle. Every industry builds ahead and operates with some stand-by capacity. This stand-by capacity is usually utilized to alleviate temporary or emergency conditions which may occur. Due to our inability to increase prices in the chemical industry, we attempt to sell out our maximum volume and thus utilize this stand-by capacity. This pressure to sell our maximum volume is both a cause and effect of the price squeeze.

It is surely a stimulus to get maximum process efficiencies, and the greatly improved earnings reported by the chemical industry this year, as compared to last, is indicative of the success of these efforts.

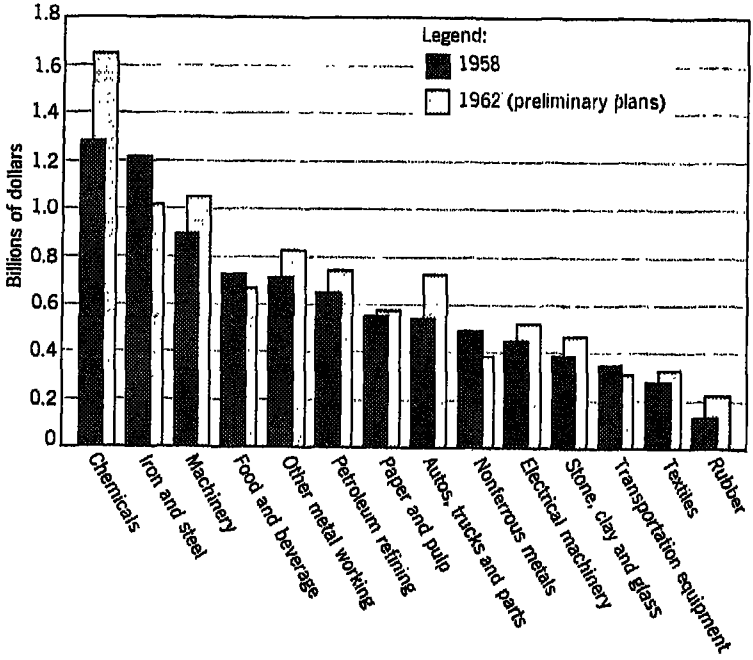
While the price squeeze is frequently lamented by chemical management, it is hard to see how the industry can other than enjoy satisfactory profit margins. The simple fact of its rate of growth necessitates satisfactory return to attract the capital necessary for new plants.

Compares Capital Spending

One of the best indicators of an industry's future is to determine what confidence and growth potential an industry exhibits itself. I believe this is best illustrated by a comparison of the capital spending plans of various manufacturing industries. (Chart II). The chemical industry's capital spending has and will exceed all other manufacturing industries. It is forecasted that in 1962 the chemical industry is expecting to spend approximately 24% more than in the year 1958, while all other manufacturing industries will increase their capital spending plans over 1958 by approximately 4%.

One of the most important factors contributing to the industry's dynamic growth is the tremendous research effort, which is continuously expended. One authoritative estimate is that 16% of the chemical industry's sales in 1960 will be accounted for by products which were not

Chart II. Capital spending plans of manufacturing industries. (Source: U. S. Department of Commerce; Securities and Exchange Commission; McGraw-Hill Department of Economics.)



in production in 1956. The chemical industry in 1959 will expend more for research facilities than any other manufacturing industry. The chemical industry is exceeded only by the electrical equipment and aircraft industries. For comparative purposes, I believe the data on the subject are slightly misleading. I am sure that a sizable portion of the expenditures of these industries are incurred for the government and are therefore defense oriented. In addition, a substantial amount of total expenditures of these two industries are development expenses incurred in the preparation of prototypes, etc. If the development expenditures could be removed from their figures, I feel the amount spent for pure research would be highest in the chemicals and allied products industry.

Conclusion

In conclusion, I have attempted briefly to present the chemical industry in perspective to our national manufacturing economy and have touched upon some of the distinct characteristics of our industry. To many, we are a glamorous industry as evidenced by the significant entry into all phases of the chemical industry by companies not primarily, or formerly, involved in chemical production. Their entry into the industry is, to a large degree, speculative. Steady future growth is insured primarily by basic chemical producers. Competition in the chemical industry is keen and unique. I believe the deciding factor in determining what companies in any industry will enjoy the fastest rate of progress and growth is the ability of management. I believe that management in the chemical industry views its inevitable growth with determination, anticipating that some day the chemical industry will be the number one basic industry in our country.

Where has the chemical industry been? Where is it going? What is its present status? These questions are analyzed from the viewpoint of an investment banker with long experience in the field. Dr. Soule discusses the reasons for the past growth and profits of the CPI and points out that a new managerial view is necessary if profitable growth is to continue.

One of management's jobs is to identify the basic trends in an industry so that it can guide the enterprise toward its objectives. To this end, the author advises that in the chemical industry it is becoming necessary to switch from merely producing basic raw materials (the traditional role of the CPI manufacturer) to the production of finished consumer products (both industrial and private). If such innovations are made by management, the firm's long-term prospects will be enhanced, and the market price of the firm's stock will reflect these prospects.

In cases presented later in this text, it will be seen that progressive CPI managements are well aware of their opportunities and responsibilities in manufacturing finished products. The recent spate of mergers, joint ventures, acquisitions, consumer oriented development programs, etc., all reflect a growing awareness by management of the importance of directing the enterprise into the more profitable segments of industry.

2 Chemical Industry's Problem: Slowing Profits

by Roland P. Soule

It is no news that the chemical industry's investment appeal has declined notably in the last decade. Leading chemical stocks still command a loyal following, but they have lost the halo that once adorned them. What adverse trends have caused these misgivings? How can management give new impetus to slowing profits? A look at the industry in long perspective suggests the cause of some of its basic difficulties as well

From *Chemical and Engineering News*, Vol. 39 (August 14, 1961), pp. 100–110. Copyright 1961 by the American Chemical Society and reprinted by permission of the copyright owner. Dr. Soule is a consultant, former vice president of research and planning at the Irving Trust Company, and a director of several corporations.

as a possible remedy. But the latter may involve abandoning a long cherished management principle.

Stock market interest is always greatest in industries that are growing the fastest. These are usually the ones that are benefiting from the newest developments in technology.

The various branches of technology have not advanced with equal speed at all times. Each had its own period of ascendancy and then was superseded by some other branch. Thus, the last 100 years in this country saw the successive rise of five types of technology:

1860–80. Civil Engineering Period. This was the first type of engineering to be distinguished from military engineering. The West was being opened up, and the railroads were rising toward the peak of their importance.

1880–1900. Electrical Engineering Period. This was the era of Bell and the telephone, Edison and the electric light, and Hall and aluminum.

1900–20. Mechanical Engineering Period. These were years when the automobile and the airplane were coming into their own. Mechanization of manufacturing operations and the concept of mass production were taking hold.

1920–40. Chemical Engineering Period. Many formerly imported chemicals were manufactured here for the first time. Our organic chemical industry was born. Scientific methods were injected into such old arts as petroleum refining, nonferrous metallurgy, and glass, paper, and rubber manufacturing.

1940–60. Electronic Engineering Period. This period saw the emergence of radar and guided missiles in World War II, and of television, computers, and data processing machines.

These ascendancies were clearly reflected in the stock market. The work of the civil engineer resulted in the rise of the railroads, and in 1890 they accounted for most stocks and bonds listed on the New York Stock Exchange. In the wake of the electrical engineer followed stocks such as Western Union, American Telephone & Telegraph, and General Electric. These were among the market leaders around the turn of the century.

The mechanical engineer was behind the great increase in the average manufacturing company's unit size, which occurred in the period after 1900. Bigger size resulted in public ownership. And by 1920 the newly created group of industrial stocks far outranked the rails in total market value. The chemical engineer's work was seen in a sharp rise in chemical stocks after World War I, placing them first in dollar value among the industrials.

And finally, the electronics engineer became responsible for some of the most spectacular market performers of recent years. Witness the billion dollar market value of Texas Instruments, the components producer. And then there's International Business Machines, the systems manufacturer, with a market value of over $10 billion—slightly more than that of the country's biggest oil company, Standard Oil of New Jersey.

Thus, the strong tail wind of technological innovation that once blew chemical firms along so briskly has changed direction. But what of the future? Will some new field, such as nuclear engineering, dominate the next 20 years to the further disadvantage of the older arts? Possibly, but a reading of the record indicates more strongly that no longer can any single branch tower above the over-all field of technology. Instead, the coming years may be marked by a trend long in the making. That is, we may witness the further breaking down of those barriers that still exist between the present engineering arts.

Chemistry and physics, once considered separate sciences, crossed their common boundary long ago. They united most dramatically in the atomic bomb and the new field of nucleonics. Also, long range missiles would have been impossible without close collaboration among the mechanical engineer for structural design, the metallurgist for alloys, the chemical engineer for fuels, and the electronics engineer for controls.

Some progress in this combining of technologies has been made in peace-time applications, but much more can be done. Here lies great opportunity for chemical management. Projecting past trends suggests strongly that companies leading in the future will be those that rely less on chemical engineering alone and more on a combination of many engineering arts.

New Direction for Research

Attempts have been made to maintain earlier profit growth rates by increased spending in chemical research. The basic concept is sound. The industry would be badly situated indeed without the new products of recent years. But too often have new products gained at the expense of the old, with the result being change rather than growth.

Sales have increased only moderately, and profits even less. Technological obsolescence has become more rapid. And the typical life span of a product from high-profit specialty to low-profit staple has been shortened. The suspicion arises, then, that the shortcoming of the chemical industry's research in the past 20 years was not its magnitude, but its direction.

Two long-term trends in over-all industry, one technical and the other commercial, suggest a new direction for research. Chemical management might be wise to give these some thought.

The first trend is very simple. It is away from products made from any single material—wood, metal, paper, and plastics—and toward products combining several different materials. Each material in the product best serves its own particular function so as to give highest quality at least cost.

The second trend results from the first. It is a continuing rise in commercial importance of the fabricator relative to the producer. For example, in 1920 U.S. Steel Corp. had over four times the assets and nearly four times the earnings of General Motors. But in 1959 General Motors, with no stake in steel, rubber, glass, or aluminum, had nearly 10 times the assets and over three times the earnings of U.S. Steel.

The rapid growth in total industrial research spending in the past 20 years was due largely to increased research activity by fabricating firms. Thus, in 1958, makers of aircraft, electrical items, motor vehicles, machinery, instruments, and other fabricated products accounted for over 80% of total research and development spending by industry. The remainder was spent by producers of chemicals, petroleum products, primary metals, rubber, foods, paper, glass, stone, and clay.

Neither the new raw materials of recent years—titanium, lithium, boron, and the much publicized exotic metals—nor new semimanufactured items such as glass fiber had repercussions on the stock market to compare with those of certain new manufactured products. Witness Polaroid Corp., which so successfully wedded chemistry with physics and attained a market value in excess of $1 billion within the past year.

Chemical firms have been slow in following over-all industry toward greater emphasis on composite construction in technological effort. Chemical research is still mainly concerned with adaptation—with developing new products from chemical raw materials and finding new markets for the products. Formerly this was all well and good. The industry could rely on expanding sales of semifinished materials for its continued growth. But increased competition has shrunk the profit margin in such materials. And the industry must look increasingly to more specialized products to restore its former attractive earnings picture.

To the extent that such products are of a fabricated nature, so is a technology of adaptation less suitable. Only by coincidence would a fabricated product made of chemical raw materials alone be both best and cheapest in its own market. Obviously, better end products can be devised by research men not committed to greatest use of their employer's existing raw materials. They should be free to choose from among the raw materials of other firms.

The chemical industry is subject not only to those basic trends affecting all industry; it also follows certain trends peculiar to itself. It is, of course, no industry at all in a true economic sense. It cannot be defined, like the steel and copper industries, as a group of companies making a common product. Nor can it be defined, like the office equipment and building materials industries, as a group of companies serving a common market. The only bond tying chemical firms together is a common use of manufacturing processes that are chemical. The result is the least homogeneous of all industries.

Each firm represents a different combination of products and markets. Some combinations, not so well suited as others to meet changing conditions, do not fare so well as others for reasons beyond management control. Hence, generalization on the ills and possible cures of the over-all chemical industry is subject to many exceptions in individual companies.

The manner of the chemical industry's past growth is also unique. Much of this was at the expense of other industries that it invaded and, in some cases, even absorbed. This ability to expand by a somewhat cannibalistic process, even in years of poor growth for all industry, became one of the chemical industry's greatest charms for investors. It was a principal reason for the high prices reached by chemical stocks and their important role in the industry's extraordinary performance after the start of the chemical engineering era in 1920.

In 1920 the chemical industry was weighted heavily by inorganics. Organic chemicals at the time were chiefly those derived from coal tar. The only production that could be called "petrochemical" was carbon black from natural gas. Yet from this modest start the industry expanded steadily in scope, and it greatly increased production in almost every line.

The Bureau of the Census defines the scope in its Code 28 classification as comprising not only inorganic and organic compounds and other primary chemicals. It also includes a so-called "chemical products" group. This covers drugs and medicines, soap and detergents, paints and protective coatings, naval stores, fertilizers, vegetable and animal oils, insecticides and fungicides, toilet preparations, printing ink, and a small group of miscellaneous items.

As thus defined, the chemical industry's growth in physical units was 25% faster than all industry from 1930 to 1940. From 1940 to 1950 it was 56% faster, and from 1950 to 1959 it was 119% faster. But chemical prices failed to rise as much as other prices. Some actually declined.

The result was that chemical sales in dollars over the entire period grew only about 40% faster than other sales.

Expressed otherwise, the chemical industry accounted for about 6% of all manufacturing sales 30 years ago and about 8% in 1959. Yet at the end of 1959 the market value of Code 28 chemical stocks listed on the New York Stock Exchange was nearly $49 billion. This was 23% of the total for all manufacturing companies.

This high proportion of market value relative to dollar sales resulted from two features long characteristic of the chemical industry. First, higher than average profit margins enabled it to produce in 1959 about 13% of total manufacturing profits, compared with only 8% of sales. Next, stocks of the largest chemical companies commanded higher than average prices relative to their earnings. The market action of these big companies, such as Du Pont, Union Carbide, Allied Chemical, Dow, Monsanto, American Cyanamid, and Hercules, heavily weighted the industry averages. Thus, in 1959 these seven firms alone accounted for nearly a quarter of the sales of the entire chemical industry. And the combined market value of their stocks was about half the total for the nearly 100 chemical companies listed on the Exchange.

A principal cause of a high price-to-earnings ratio is, of course, a high rate of growth. Between 1940 and 1959, sales of these seven firms increased a third faster than the over-all chemical industry, and all of the gain occurred before 1950. Rates of growth of individual firms and of the industry's divisions varied widely, reflecting its basic lack of homogeneity. Sales of primary chemicals rose more than those of chemical products.

Among primary chemicals, organics grew much faster than inorganics. The 1920 relationship was entirely reversed, with organics growing to about 70% of the total dollar value. Within the organic group, cyclic chemicals were far outrun by the straight-chain hydrocarbons derived largely from petroleum and natural gas. Organic chemistry's main end products used to be dyes, intermediates, and explosives; now they are synthetic fibers, synthetic rubber, and plastics. Until recently synthetic fibers ranked first in importance in the entire industry. Now plastics lead, both in dollar value and in apparent promise of continued growth.

The rise of petrochemicals—raw materials and intermediates originating from petroleum and natural gas—was an outstanding phenomenon of the period. They probably accounted last year for 30% of the weight and 60% of the dollar value of all chemicals exclusive of chemical products.

In Recent Years, Slowing Profits

The chemical industry's record of the last decade was above the average of all industry. Yet, from the investor's standpoint, that record was disappointing compared with the outstanding performance of the chemical industry in earlier years. Between 1950 and 1960 the seven biggest companies increased their gross operating investments by an average of 221%. But their sales expanded only 142% and their net profits 70%. And because they issued additional shares to finance their growth, earnings per common share rose by an average of only 42%.

Obviously, the chemical industry lost many of the bulwarks of its high profit margins—restricted raw materials, secret processes, complex technology, and large capital needs to obtain competitive costs. Long the great invader of other industries, it was itself invaded. Some of the invasion came from foreign chemical companies, but more came from domestic firms not previously making chemical products.

Some of the firms were in such improbable industries as meat packing, shipping, machinery, flour milling, and liquor. But the main invaders were the rubber and oil companies. Nearly every major U.S. oil refiner entered some part of the burgeoning petrochemical business. Four of them accounted in 1959 for more than one tenth of petrochemical sales in this country.

Industrial Research & Development: Fabricators Outspend Producers in 1958

Material Fabricators	*Millions of Dollars*	*Material Producers*	*Millions of Dollars*
Aircraft	$2,498	Indl. and other chemicals	$ 656
Elec. equip. & communication	1,947	Petroleum refining & extraction	245
Motor vehicles & other transp.	850	Primary metals	130
Machinery	781	Rubber	88
Instruments	288	Foods	80
Drugs and medicines	128	Stone, clay, and glass	65
Fabricated metal products	125	Paper	51
Other manufacturing industries	160	Other nonmfg. industries	152
Total fabricators	$6,777	Total producers	$1,467

Total fabricators	*$6,777*	*82%*
Total producers	*1,467*	*18*
	$8,244	*100%*

Source: National Science Foundation, "Reviews of Data on Research and Development," May 1960.

The oil firms were particularly formidable competitors. They were producers of ethylene and propylene, two building blocks of the petrochemical industry; and the larger firms had research organizations as capable as almost any in the chemical industry. Moreover, complex technology was less of an obstacle even to smaller companies with only modest research facilities of their own. Contracting firms offered complete plants that would make them instantly and fully competitive in many operations with companies already in the field. And finally, the oil industry had great capital resources. Faced by a world-wide oversupply of petroleum that discouraged internal expansion, it turned eagerly to chemicals for new investment opportunity.

Chemical products that were high in sales volume and profit margins particularly attracted the newcomers. As a result, many important specialty products underwent accelerated decline toward becoming staples, sold largely on a competitive basis. This transition from high profit specialty to low profit staple is nothing new in chemicals. The traditional answer has been to develop new specialties to replace the old. But increased competition is shortening the life span of many of them and lowering the return they can earn. What new synthetic fiber can be expected to fare as well in the future as viscose rayon and nylon did in the past?

The chemical industry is the biggest, and probably the last, of the so-called growth industries to expand largely through a technology of adaptation. It was able to cling so long and successfully to this policy because of the extraordinary versatility of certain of its products.

Among inorganics, the elements most capable of conversion into a wide variety of salable compounds were chlorine and nitrogen. But carbon, of course, proved to be the most versatile of all in number and range of its marketable compounds. This, plus its low cost in the form of petroleum and natural gas, provided a main driving force behind the chemical industry's expansion in the past 30 years.

But even petrochemicals are no longer expanding so rapidly. Their growth rate in pounds was 15% from 1950 to 1955 and 11% from 1955 to 1960. For the next five years the rate is forecast at less than 9%. Continued concentration on a policy of adaptation, however susceptible to this technology the materials may be, must ultimately meet its own law of diminishing returns.

As a result of these trends, investors now view the chemical industry with mixed feelings. On the favorable side, they continue to value the downside protection its great diversity of products and markets provides. And they are confident that, even if further slowing in some product groups' earnings should occur, the industry's expansion on other fronts will more than offset the loss. Viewing it as a whole, therefore, they see more attractive investment opportunities in chemicals than in many other industries.

But on the less favorable side, its investment ranking over other industries has narrowed. Leading chemical companies no longer command a 30 to 50% premium in price-to-earnings ratios over the average of Dow-Jones industrial stocks. In general, this margin has been cut in half and in some cases eliminated completely.

A main reason for the decline is investor doubt that big chemical firms can regain their former fast growth rate. Increased diversity retards the movement of earnings not only downward, but upward as well. Too, increased size is a handicap. It is much harder for a billion dollar company to maintain a fast growth rate by adding new products than for a firm one tenth as large. The bigger and more diversified a company becomes, the more its growth rate tends to gravitate to the all-industry average. Hence, many investors seeking highest capital gains in the chemical industry now tend to forsake the large companies listed on the New York Stock Exchange. Instead, they place their bets on some of the smaller firms in the over-the-counter market. They look for youth rather than maturity. They hope to find a company that will grow as fast as a limited group of products can grow in a well favored section of the industry. Such investments are frankly speculative, of course, since youth not only offers more promise, but involves more risk.

Remedy for Large Companies?

What can give new impetus to the chemical industry—more particularly to the bigger firms that make up such a large part of it? Obviously, they cannot be made smaller or less diversified to recover their lost youth. What is needed are wider profit margins and recapture of rates of return more characteristic of past performance.

If this long view of the chemical industry's position relative to other industries suggests any one course of action, it is to move its emphasis away from adaptation and more toward independent design.

That move would be a shift from its traditional position as mainly a producer of intermediates and semifinished goods. It would be a shift toward a new position as a fabricator of end products, many of them branded and directly sold in consumer markets. It would be a move toward composite construction and greater use of *all* engineering arts.

In short, it would be a move in conformity with basic trends of long standing.

Consider the current situation in plastics. This is the chemical industry's most important division, and it is believed by many to hold the greatest promise of growth. Most primary plastic materials in this country are made by about a dozen large companies. These sell to hundreds of smaller satellite companies, which make the plastic materials into their final form.

One difficulty with the setup is that a satellite company sometimes integrates backward and starts manufacturing part or all of its own primary plastics. Thus, often the better a customer it becomes, the more likely the chemical firm is to lose it as a customer. But there is a far more basic difficulty. By and large, the satellite firms lack financial resources, know-how, or disposition to develop and sell plastic end products to the fullest possible extent.

Obviously, it is not easy for a chemical firm to decide to go into the business of making end products based on its own materials. First, there is that long-cherished management principle expressed by the hoary shibboleth, "Don't compete with your own customer." The obvious answer here is don't do it unless new business to be won promises to more than offset the old business lost. And this could mean don't do it if you must enter a field already dominated by large and successful companies.

Secondly, the new end product may also use raw materials made by others. The answer to this may lie in organizing a new company to be owned jointly with the other manufacturer.

Finally, the new product may require selling outlets and merchandising know-how entirely lacking in the chemical firm. While these are not readily available, they can often be acquired on the outside as already demonstrated by the experience of others.

Developing a new business of this type is likely to be a slow and difficult job. But the potential rewards are great. Benefits of a consumer franchise are usually reflected in higher and more stable profit margins. Branded end products are far less vulnerable than staples both to price competition and to obsolescence. Witness the superior performance of Scott Paper and Kimberly-Clark in the paper industry. And look at the merger of technologically vulnerable ethical drug firms with the makers of proprietaries to get the benefits of trade-marked specialties.

Du Pont has long benefited from a product structure heavily weighted by consumer items and by a company name favorably known to the general public. Recognition of the value of a consumer-oriented subsidiary was shown when Union Carbide acquired Visking, Dow acquired Dobeckmun, and Cyanamid acquired Formica.

Perhaps the outstanding example of a fabricator of consumer items is Minnesota Mining & Manufacturing Co. This concern began as a producer of silica granules for sandpaper and asphalt roofing. It has evolved into an organization with a genius for developing and marketing consumer items made from new combinations of raw materials. And the latter originate largely outside the company. Minnesota Mining stock now commands the highest price-to-earnings ratio in the chemical industry. In the past 20 years the stock has soared in market value to an amount almost equal to that of Union Carbide, which ranks second in the industry.

A look at the past in long perspective is sometimes helpful in planning a course for the coming years. Thus, a remedy for the chemical industry's slowing profits may be found after a diagnosis of its present condition. The prescription in broadest outline is simple. Follow the precedent of the most successful industries, and conform with those basic trends that promise to continue most strongly in the future.

Traditionally a "high profit" industry, the CPI seems to be entering a new and less profitable period. For the past ten years, although the industry's sales have gone up, its return on investment has declined. Whether this is temporary and can be corrected by strategic moves, e.g., diversifying into consumer products, or whether this is symptomatic of the industry's evolution into the *maturity* stage of its life cycle, remains to be seen.

This article points out some of the factors now contributing to the declining profits of the CPI, i.e., foreign competition, invasion of traditional markets by new producers, price cutting, overcapacity, etc. The industry outlook, however, is by no means bleak—a number of successful expedients have been and can be employed by individual firms in order to maintain or improve their position. The author illustrates these strategies by particular reference to the business performance of Dow Chemical Company; he shows how Dow has gone ahead into consumer products, developed many new products, originated new customer services, etc. In essence, we have the detailed record of a large and effective CPI enterprise in a successful counteroffensive against the many pressures tending to reduce its profits.

3 Chemicals: The Ball Is Over

by Perrin Stryker

By last summer it was clear that another boom was starting for U.S. chemical producers, who despite ups and downs have enjoyed some spectacular growth rates. The business of Dow Chemical Co., for instance, which in the last decade built more plant per dollar of sales than any other major chemical producer in the U.S., soared from $220 million in 1950 to almost $820 million in fiscal 1961. Last spring Dow could announce that it had recorded "the biggest May in our history," and

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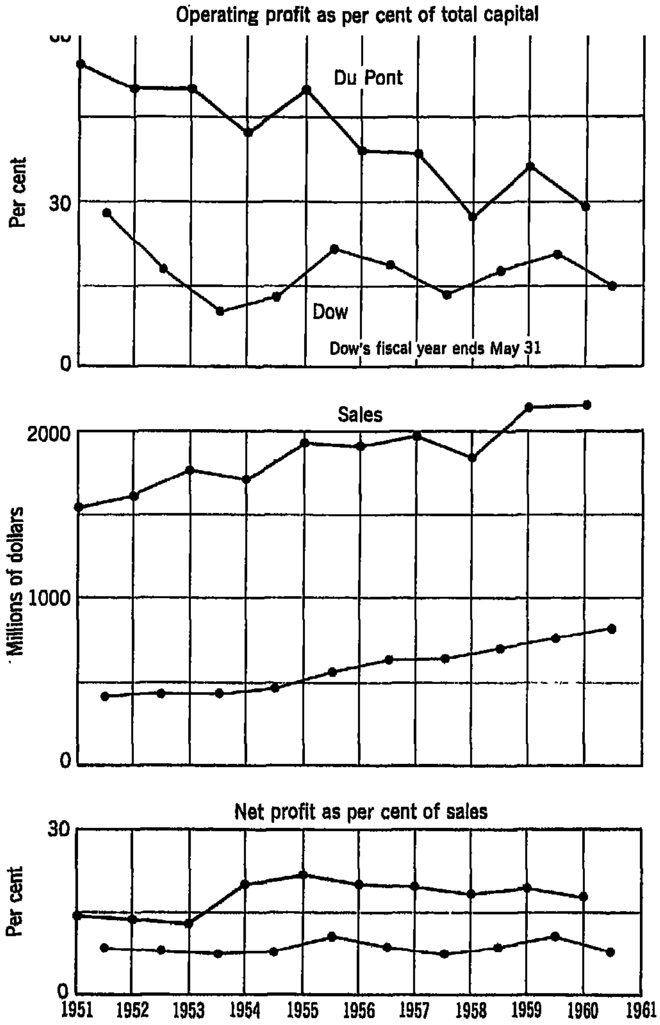


The industry's troubles: Squeezed profits. The fall-off in the earning power of two major U. S. chemical companies since 1951 is shown in the three rows of charts above. These reveal the significant overriding facts that despite a notable rise in sales volume *(middle row)* the operating returns on capital have declined *(top row)*, while profits as a per cent of sales *(bottom row)* have remained relatively stationary. The experience of both the giant du Pont and an expanding Dow has been fairly typical of the chemical industry. Some companies to be sure have bucked the above trends, others will in the future; and earnings will no doubt improve with the present economic boom. But returns on capital for the industry as a whole seem to have passed their peak.

Dow's chairman, Carl A. Gerstacker, now vows that "Dow will continue to meet its historic sales growth rate," which averaged about 14 per cent a year between 1950 and 1960. Moreover, he firmly declares that individual companies, emphatically including Dow, "can maintain profit margins as good as and even better than those they have enjoyed in the past."

But all this good news covers up some considerable trouble within what has been an outstandingly profitable industry. And the profit record, about which Gerstacker is so optimistic, is symptomatic. For while Dow's sales have kept steadily mounting, peak profits as a per cent of sales fell from over 15 per cent in 1950 to less than 11 per cent in Dow's fiscal 1960. What happened to Dow also happened to its four big competitors, du Pont, Union Carbide, Allied, and Monsanto. Even more significant are the figures showing return before taxes on total capital employed in the business (i.e., including long-term debt). Since the war the rates of this operating return of these five largest chemical companies have reached three peaks but, significantly, each of the last two peaks has been lower than its predecessor.

Dow, for example, showed a 36 per cent return on capital employed in 1951, 21 per cent in 1956, and 20 per cent in 1960 (see chart page 25). In the fiscal year ended last May, Dow's return dropped to 15 per cent. Du Pont's return fell from over 54 per cent in 1951 to 29 per cent last year. To be sure, the Korean war was partly responsible for the peak earnings of the early Fifties. Capital returns since then have continued to be substantial, but there are some financial analysts who also believe that the U.S. chemical business has seen its most glamorous days and is, like the oil and automotive industries, entering a stage of "maturity," even as regards volume. In this stage its average growth rate, now at around 8 or 9 per cent, is expected to subside to 5 or 6 per cent.

The troubles of the chemical industry are threefold:

First, there has been a heavy invasion of the industry by new companies. Chemical production is no longer confined to the major "general chemical" companies like the big five and their smaller counterparts, such as Hercules, Stauffer, Spencer, and Pennsalt, and the pharmaceutical companies (e.g., Merck, Johnson & Johnson, Parke, Davis, Bristol-Myers, etc.). Among these newcomers to the industry are National Distillers, W. R. Grace & Co., the five major tire makers, and all the major oil companies. In addition, various producers of soap, paper, paint, metal, glass, and other "chemical processing" companies have got into the chemical business on their own.

Second, pressures and counterpressures from the invading companies, rising costs of labor, construction, and raw materials, and declining prices of chemicals (especially plastics) have combined to set up a severe cost-price squeeze. Overcapacities have meant low operating rates and consequently higher operating costs, which have greatly intensified the squeeze.

Third, the companies are facing a dilemma caused by their own recent and swift expansion abroad. Last year about 15 per cent of the $1.6-billion capital expenditures made by American chemical producers went into expanding overseas production, and this expansion, along with the rapid growth of European companies, has already started to reduce the flow of U.S.-made chemicals to Europe. Moreover, more capacity has recently been developed abroad in some products than the European market can absorb, and this excess production may seek U.S. markets, which are already plagued by overcapacity. If that happens, the protection of U.S. import duties on chemicals, still considered essential by most American producers, may become a seriously embarrassing restriction.

From Salts to Handi-Wrap

The sixty-four-year-old Dow Chemical Co., as it turns out, affords a very good way to look at a number of aspects of the whole industry. Dow is heavily involved in all the industry's major problems. When FORTUNE last looked at Dow (see "The Dow Expansion," May, 1952) it found that the chemical "industry was expanding, but Dow was expanding even faster." Since then the company has spent almost $1 billion on new plant and equipment, pushing boldly ahead with its policy of expanding continuously, regardless of what the rest of the economy happened to be doing. Dow's motto of "Never stop building" has led it to build plants in twelve states and fourteen foreign countries.

Its founder, Herbert H. Dow, was a farsighted chemical student who in 1890 bought up some flat Michigan farmland that covered a large pool of prehistoric brine. Using a new electrolytic process he had devised, Dow first extracted potassium bromide from the brine, then the salts of chlorine, sodium, calcium, and magnesium, and in 1897 he organized Dow Chemical Co. to make bleach from chlorine. Later Dow processes extracted more and more other chemicals from oil, salt, and air. Today Dow makes virtually all of the basic chemicals it needs, and its twenty-seven processing plants are scattered from California to Vermont. Dow is probably one of the most integrated producers in the field. Its research and development programs have produced an endless stream of products, which now number more than 1,000, ranging from such basics as chlorine and magnesium to intermediate petrochemicals to finished consumer goods, such as Dowgard antifreeze, Saran icicles for Christmas trees, and Handi-Wrap, a plastic film priced low enough for housewives to use it in place of waxed paper.

This diversity of products is typical of the chemical business these days and gives rise to unique problems. The industry sells some 11,000 products in all, and some 400 new items are introduced to the market every year, of which only a very few will sell in volume. No two chemical companies carry the same line; only about 10 per cent of du Pont's sales, for example, are in products comparable to those marketed by Union Carbide. It is now difficult to arrive at even an approximate figure for total chemical sales in the U.S. The Department of Commerce publishes a total sales figure ($27.7 billion last year) for "chemical and allied products," which among other items includes the sales of the cosmetics industry along with sales of nonfat oils.

In this enormous field each company must decide whether it will sell its own basic chemicals, or process them into intermediates for sale to fabricators, or process them still further into finished items to be sold direct to the consumer. Sometimes a chemical company shifts from selling a big customer a basic chemical to competing with that customer by upgrading its own output to an intermediate or finished product. The chemical producer must also decide whether to spend huge sums on research for completely new things, or to invest heavily in plants for making an already established product like polyethylene, for which, despite its rapidly declining price, there is already far more plant capacity than is needed for present market demand.

The secret of success in the past has been to find a unique and highly profitable product and maintain an exclusive market for it as long as possible. Today, however, this formula is becoming increasingly difficult to achieve because so many companies are developing so many new competitive products. Hence the vital "lead time," in which a company can capitalize on a new product, is shrinking. This shrinkage is considered by some experts in the industry to be the most serious obstacle to future profits.

The Invaders

Most of these problems have obviously been compounded by invading companies, which, as suggested, comprise a formidable and heterogeneous horde. Some of these invaders are old customers of Dow, Union

Carbide, *et al.* that grew cost-conscious and decided they themselves would manufacture some of the chemical raw materials they used. The big rubber companies, for example, are now making chemicals to produce synthetic rubber for tires and other products. In the early Fifties, when chemical stocks enjoyed the reputation of swift growth and high profits, some corporations apparently saw a chance to enhance the value of their own stocks by acquiring chemical subsidiaries. National Distillers bought U.S. Industrial Chemicals and W. R. Grace bought the Davison Chemical Co. and watched Wall Street's quotations on their equities rise, thus increasing their borrowing power for further expansion.

Other corporations invaded the chemical business primarily for the sake of diversifying and getting a larger return on their surplus capital. Rexall Drug began by joining up with El Paso Natural Gas Co. to build a polystyrene plant. In 1958 it bought a small plastic-pipe company and a plastic-housewares fabricator. Finally in 1960, Rexall and El Paso Gas agreed to join forces to produce polyethylene and polypropylene, thereby intensifying competition in the critical field of petrochemicals.

Since the war, byproducts of the gas and oil industry, from which petrochemicals are made, have become the most important sources of chemical products. All the big established chemical companies have huge petrochemical complexes located next to refineries and natural-gas wells; Dow's plants near gas wells at Freeport, Texas, for instance, have grown into a $500-million complex for providing low-cost basic chemicals to its processing plants in the U.S. and Europe. Dow now gets about half its sales volume—and probably much more than half its profits—from products derived from petrochemicals. It was not too surprising, therefore, that when the big oil and gas companies found their profits flagging in the mid-Fifties, they decided to upgrade their own refinery byproducts instead of selling these as basic raw materials to the chemical companies. Today all the major U.S. oil companies plus other newcomers are strenuously selling petrochemical products; and still other invaders have got heavily into agricultural chemicals and polyvinyl chloride. The most important result of all this competition has been to bring down prices on big-volume items.

Three Strategies

Dow and the others have attempted to meet the new competitive threats by: (1) discovering and developing new products, and improving old ones; (2) providing new customer services; and (3) "forward integration"—i.e., expanding into the production and marketing of consumer items. In Dow's case, R. and D. regularly has turned up scores of new products every year; of these, perhaps only 1 per cent would eventually be marketed successfully. But even on that 1 per cent Dow has done very well. New products introduced over a five-year period (1956–60), each of which produced $50,000 or more in annual sales, accounted for 10 per cent of the company's total 1960 sales of $780 million. Perhaps even more significantly, Dow has reduced from five to four years the time lag between the discovery of a new product in the laboratory and its arrival on the market.

Dow now spends about 5 per cent of its sales income on research and development (i.e., $40 million in fiscal 1961), and in the last ten years invested about $4 in plant for every $1 it spent on R. and D.; the corresponding ratio for du Pont in this decade was $3 per R. and D. dollar. Dow intends to keep its R. and D. costs down by finding practical uses for whatever research turns up in its laboratories. Dow research in agricultural chemicals and biochemistry, for instance, led to the discovery of an insecticide that can be sprayed on or fed to animals. To market this and future products of such research, Dow last year bought its way into the pharmaceutical field by acquiring Allied Laboratories of Kansas City.

Dow's second answer to the competition of the newcomers is to consolidate its relations with its customers by furnishing them with technical advice and services. Back in the Thirties, Dow set up its Dowell Division, which furnishes field services (and chemicals) to oil and gas wells in the U.S. and overseas. After the war Dow sent technicians into the plants of plastic fabricators and into paper mills that used Dow chemicals. Dow's technical men help track down mechanical bugs and show the customer how to get more out of his machines at lower costs. Since Dow started these services, practically all the big chemical companies have followed suit; according to Dow's Executive Vice President Ted Doan, other companies simply copied Dow's service methods for cultivating the orders of plastic-molding producers. Dow has set up a separate Industrial Services Division devoted to providing services to big industrial users of its chemicals, to municipal water and sewerage plants, and to missile makers. This solicitude is counted on to maintain patronage for Dow's products in places where price alone is not enough to guarantee the sale. "This is an intricate tool in competition," says Doan. "It's essentially a question of understanding your customer's cost problems." In his opinion, only the major chemical companies, and practically none of the newcomers, have technical staffs capable of supplying such services.

The third response to new invaders has been "forward integration"—

a path pioneered by du Pont and Union Carbide, which have long had a policy of moving right in on the consumer. Dow adopted the policy in 1952 when it put its saran film on the consumer market as SaranWrap, a roll of transparent plastic sheeting for wrapping household items. SaranWrap has been one of Dow's most profitable products, in spite of its high price (compared to waxed paper) and its tendency to cling so tightly to itself that consumers, and frequently embarrassed Dow salesmen, have great trouble unwinding it. In 1954 Dow started to sell ethylene glycol antifreeze under private label to oil, auto, and farm-equipment companies. Since 1956 the stream of new products aimed directly at consumer markets has included Korlan (insecticide), Kuron and Dowpon (herbicides), Trolene (cattle grub killer), Dorlone and Telone (soil fumigants), Scorboard, Saraloy, Pelaspan, and Roofmate (building plastics), Metalflake and metallized SaranWrap Christmas-tree icicles; Rockshock (for stimulating oil-well flow), Zefran and Rovana (synthetic fibers), and Handi-Wrap (a nonclinging polyethylene film for the householders). In addition, Dow strengthened its grip on consumer markets when in 1958 it acquired Dobeckmun Co. of Cleveland, Ohio, which specializes in packaging made of plastic film and aluminum foil. From Dobeckmun Dow will gain "technical know-how" in the packaging business.

As a result of all these moves Dow's top managers are confident they can handle the new situation. Gerstacker points out that while oil companies and others may build petrochemical plants and turn out standard chemical products, "they haven't gotten into the business of making and printing plastic wrapping film for bread, because in technical areas such as these you have to have the know-how." Nor does he believe newcomers are likely to improve their products as Dow has. He can point to Dow's polystyrene, for instance, which is far different from the polystyrene it first made in 1937. Dow is now working on a "high-impact" variety that will represent the twenty-ninth improvement it has made on this one product. "There is a tendency," Gerstacker says, "for customers to look too narrowly at price and assume that a chemical product is a chemical product, that polystyrene is polystyrene."

"A Little of Everything"

Dow's commendable emphasis on quality, however, is no insurance against competition and the cost-price squeeze. For customers may not be willing to pay a premium for improved products when older, lower-grade products will do the job and are being offered at declining prices. Nor is this all. As Gerstacker says: "A little of everything has led to the cost-price squeeze." Labor costs in the industry, he claims, have risen 80 per cent in the last ten years, while productivity has gone up only about 40 per cent. Some companies are trying to cut labor costs by installing computer-controlled processes. Gerstacker, however, considers this "a glamorous but lousy example of cost cutting," because it will take so many years for these expensive systems to pay out.

Most raw-material costs, it is true, have dropped over recent years; e.g., a Monsanto study showed that the costs of its purchased materials have declined more than 17 per cent since 1953. The prices of a few necessities, however, have risen sharply, as shortages developed; thus benzene, perhaps the most important raw material used by Dow, rose from 13 cents a gallon in 1946 to 40 cents in 1954; it recently fell back to 31 cents. Since benzene, a byproduct of coke, grew short whenever the steel industry slowed down, Dow decided a few years ago to look for a practical way to produce it from crude oil. Part of the process Dow developed is now used by most U.S. oil companies. To get costs still lower, and as protection against future price rises, Dow has built two benzene plants that can supply up to a quarter of Dow's requirements. Other chemical companies are also building benzene plants in a kind of counterinvasion against the oil companies. To hedge against rising railroad rates (up over 20 per cent since the war) and to take advantage of cheaper water shipments, Dow has leased three specially designed tankers. Gerstacker believes Dow is about "holding its own" in this area. But he concedes that Dow has not been able to do much about rising construction costs on its new plants.

All such efforts to improve efficiency, however, have not relieved Dow and its competitors from the painful pressures now exerted on their profits by the declining prices of many of their major products. To be sure, prices of basic inorganic chemicals like sulfuric acid have risen 20 per cent over the last ten years; but prices of petrochemicals have dropped 7 per cent and prices of plastic products have fallen 23 per cent during this period. In part price reduction is the normal and traditional passing on of technological gain to the consumer, but it also reflects new pressures.

Polystyrene molding and extruding resin is a case in point. Dow has been making this plastic for twenty-five years and is the largest U.S. producer with a capacity of 300 million pounds a year. Since 1955, the industry's annual sales of this resin have risen 75 per cent to about 700 million pounds, and Dow's sales volume has risen rapidly as it devised new varieties of this plastic. Nevertheless, competition among sixteen producers has driven the price of polystyrene down from 27.5 cents in 1956 to less than 17 cents a pound. Since the cost of the basic raw material (styrene monomer) is over 11 cents a pound, and since conversion costs are around 2 cents a pound, there is only about a 3-cent margin to cover research and development, marketing, shipping, overhead, and profit. Small wonder that even though Dow's sales volume has gone up its dollar sales of polystyrene have remained constant, and, despite many cost reductions in manufacture, Dow is making less money on polystyrene than it did five years ago. Last year Dow raised the price of its polystyrene by 1 cent a pound, in a rare instance of trying to buck the trend. However, Dow was forced to retract its price increase when none of the fifteen other producers followed suit.

Price cutting on bulk items in the face of rising costs is "poor economic statesmanship," according to Stauffer Chemical's administrative vice president, Archie E. Albright. Nevertheless the shaving of prices goes on constantly. One company may underbid another in order to get an order; the next year a still lower bid is likely to carry the business back where it came from. "So the price is down $8 a ton," one man complained about a case of this kind, "and who's ahead?" In selling bulk items, every chemical company will try to meet its competitors' bids not only right to the penny but to the third or fourth decimal place. Since basic prices are listed and transportation costs known, each company can calculate exactly what price will have to be met. Identical bids are thus the rule, a fact that recently caused a stir in New York when it was reported that for the last ten years the city had been receiving identical bids from three producers of chlorine. To the industry all this is the sign of active competition. Dow's Ted Doan says, "Identical prices are inevitable. I wouldn't be surprised if they were identical down to the fifth decimal point."

Too Much and Too Little

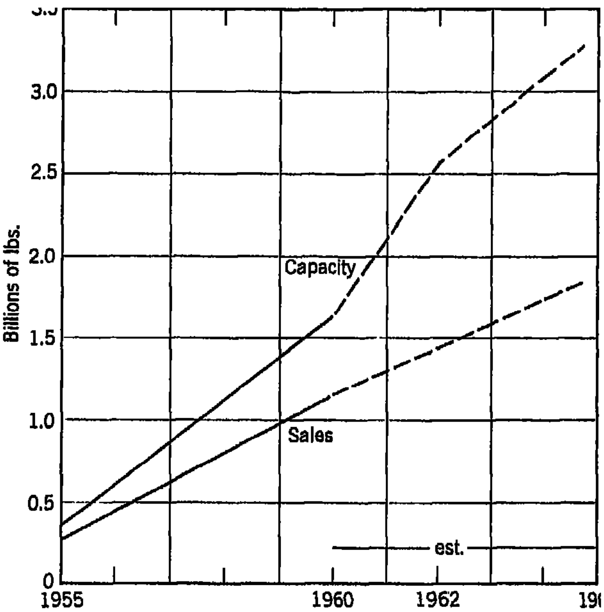
There is not the slightest doubt in the industry that overcapacity is partly responsible for price pressures, which have been intensified by the invading outsiders. In recent years it has become possible for a nonchemical company to buy a complete, ready-made chemical plant from an engineering firm. Thus newcomers avoided the huge expenditures that went into developing the technology for such plants, and rushed into manufacturing those products, especially plastics, in which they thought they could make the greatest return on their investment. The old-timers joined the rush in order to secure their share of these new fast-growing markets. Building overcapacity is certainly not new to the chemical industry; one of the chief strategies has been to build excess capacities to meet the calculated future demands. But in this latest competitive rush, according to du Pont's Vice President David H. Dawson, "the industry is acting like a low-investment industry instead of a very high-investment industry." Recently many plants were operating between 70 and 75 per cent of capacity, and in some cases the operating rates were much lower. At such levels, operating profits grow very thin to nonexistent.

Even more disturbing to many in the industry is the fact that the big chemical companies and newcomers alike have been rushing to build new plants to produce products in which serious overcapacities already exist. Most of this expansion has occurred in facilities designed for making the new varieties of plastics that have become the hottest items in the chemical market, polyethylene and polypropylene, for example. Dow did not enter the polyethylene race until 1955 when it built a small (25 million pounds a year) plant in Texas. By that time Union Carbide and others had built so many plants that Dow foresaw increasing overcapacity and figured the price of this petrochemical would eventually drop below what Dow could expect to make a profit on. Overcapacity surely did develop: from 450 million pounds a year in 1955 total capacity shot up to 1.7 billion pounds in 1960, or some 500 million above demand.

But watching the fast-expanding polyethylene market, Dow decided it had to get into the game anyhow. "That earlier decision on polyethylene was one time we held back," Gerstacker says, "and we were wrong." So in the last three years Dow has built three more polyethylene plants, and is today, with a capacity of 175 million pounds, the fourth-largest producer. Dow has been able to sell or absorb internally all its production, which is fine for Dow but has made the whole problem of excess capacity in the industry more acute.

The number of polyethylene producers will grow to at least twenty by 1965. What this will do to the polyethylene situation is dramatized in the chart below. Next year polyethylene capacity will be almost twice market demand.

Another rush is developing for a similar plastic called polypropylene. Dow is not holding back on this gamble, having one plant on stream and two more under construction. Sales were only 33 million pounds last year, but by the end of 1961 seven producers will have a capacity of 375 million pounds, and by 1963 two more producers are expected to add another 110 million pounds of capacity to the total. Demand is



Growth of polyethylene. A major contributor to the cost squeeze is excess capacity developed by new and old companies in many of the fast-selling products like polyethylene, whose swift growth, past and projected, is charted above. Because capacity in this plastic is growing far faster than sales, operating rates have fallen, resulting in both higher costs and continuous price cutting since 1955.

estimated to reach nearly 375 million pounds by 1965, but by then, even if no more plants are built, excess capacity may amount to 110 million pounds. Several chemical companies are being cautious about the polypropylene gamble. To get into the market without any plant investment, du Pont, Monsanto, and Rexall, among others, recently signed agreements to market polypropylene made by competitors; du Pont will market Hercules Powder's product, Monsanto will market Dow's, and Rexall will market AviSun's.

The only real answer to overcapacity appears to be to find new markets for upgraded products. This is the really tough job in the chemical industry today. The actual success or failure of a company in marketing is attended by an extraordinary reticence. No chemical company that FORTUNE talked to would reveal its sales figures, either in dollars or in volume, on *any* specific product. The reason is that each company keeps looking for new markets that its competitors aren't aware of, and once such a "unique situation" is found, the secret is closely guarded.

Union Carbide's Chemical Co. Vice President John A. Field told

FORTUNE that the reason other companies had not been tempted to take certain of Carbide's markets away was because they didn't know how large a share Carbide had. There is a question, however, whether security is as tight as some chemical executives think it is. Indeed, R. M. Joslin, vice president of Union Carbide's Plastics Co., declares that "our own people know within 1 per cent what amount of products are sold and who sells them. I am convinced that other chemical companies have equally smart people in their market-research divisions." All that Dow now furnishes is a breakdown of its sales by five broad divisions, whose relative importance, as the following table shows, has *apparently* changed little in the last ten years:

	1952	1961
Industrial chemicals	52%	51%
Plastics	29	35
Magnesium	11	7
Fine chemicals	3	—
Agricultural chemicals	5	7

What are covered up by these figures are the sales of big-volume items and the changes in profitability of certain products within these groups. Among the plastics and industrial and agricultural chemicals, Dow and other companies have unquestionably found many highly profitable items that have enabled them to pay off the huge sums they have expended on research and new plants.

Nylon was an outstanding example of such a discovery. Du Pont had the market for its patented treasure exclusively to itself for fifteen years until concern over a possible antitrust suit, among other considerations, induced it to license Chemstrand Corp (now owned by Monsanto). Some of du Pont's competitors estimate that its great break-through in nylon furnished 30 to 40 per cent of du Pont's profits over a period of years. However this may be, it seems unlikely that any company in the industry will see such rewards again. For chemical discoveries have become so profuse and complicated that a company today can't expect, at best, to enjoy more than three or four years of lead time in which to recoup the investment required to find and develop a new product.

Indeed, the brief lead time enjoyed by du Pont's new Delrin plastic seems to be an ominous portent: introduced in 1960, Delrin was expected to gain a big exclusive market as a replacement for nonferrous metals. Total development costs including pilot plant ran to $50 million, but material costs of Delrin are relatively minor—i.e., about 6 cents per pound, or one-tenth of the current price. But in 1961 Celanese brought out Celcon, a plastic that has the same metal-like properties as Delrin, and was priced competitively with it. Du Pont shortly filed suit charging infringements of patents, and if it wins it may manage to capitalize fully on its research. But if du Pont loses the suit it will face increasingly tough competition and possible price cutting.

Wanting It Both Ways

Finally, we come to the problem the U.S. companies face overseas. Although Dow has been selling abroad for nearly sixty years, it lagged far behind both Monsanto and Union Carbide in developing this business. There was a traditional belief at Dow that American companies ought not to manufacture abroad, because this would, in effect, "export American jobs": American exports would be reduced, American plants would have to cut back production.

Back in 1952, however, Dow's directors decided to exploit the overseas chemical markets. They authorized a joint-venture with Japan's Asahi Chemical Industry Co. for the production of saran filaments for Japanese fishing nets. Since 1954 Dow has set up nine more foreign associated companies (in which foreign interests range from 25 to 80 per cent), and twenty-two wholly owned subsidiaries. By last year Dow was manufacturing products in seven countries, and had plants under construction in nine (Greece, Italy, France, Holland, Brazil, Colombia, England, Australia, and India).

Most of the other large chemical companies are also planning to keep right on building new plants abroad, and are determined to increase capacity wherever they think this would ensure a profitable share of a foreign market. Lower taxes, faster depreciation rates, lower labor costs of foreign operations make possible an alluringly high rate of return on investment. The U.S. companies are well aware that if they did not build abroad someone else would, and thereby take away the share of the market that the U.S. once supplied with exports.

"Another U.S. Market"

The companies are counting heavily on the continued rapid expansion of foreign markets as living standards continue to rise. As du Pont's Dawson recently put it, "With the development of the Common Market you can now build one plant instead of six. It's like having another U.S.

market open up." In fact, statistics indicate that Europe's markets for chemical products are more promising than the domestic one; for example, between 1950 and 1958 gross national product per capita rose 110 per cent in Germany and 60 per cent in France compared to an increase of only 35 per cent in the U.S. during that period. The growth prospects in Europe and elsewhere have stimulated U.S. chemical producers to a point where overcapacity is appearing abroad. As a result, a serious saturation of foreign markets may develop accompanied by increasing pressure to push foreign-produced exports into the U.S. Dow, for one, has already been hurt by low-priced chemical solvents from Europe that recently took away so many customers that Dow gave up the fight for the time being and closed down its new chemical-solvents plant at Plaquemine, Louisiana.

In view of this situation, which the U.S. chemical industry itself is helping to develop, executives find themselves on both sides of the protective-tariff question. Dow's President Leland I. Doan, for example, thinks "we can live with the present tariffs," but Chairman Gerstacker, who is the president of S.O.C.M.A. (Synthetic Organic Chemical Manufacturers Association), a protectionist lobby, argues strongly for a system of tariffs that would approximately equalize U.S. labor costs and the labor costs of each foreign country. Gerstacker points out that Dow pays $3.60 an hour (plus 40 cents in fringe benefits) for work that in Japan costs only 60 cents an hour (with no fringe benefits). "What we need," he says, "are equalizing tariffs. If labor costs are equalized, then I say that, except for strategic materials, let all goods flow unhindered between countries." This is scarcely a new idea, and few economists would agree with it, as FORTUNE pointed out in "U.S. Foreign Economic Policy" (June, 1958). In any case it is clear that the industry would like to have, if it could, the best of both worlds: protection at home and no restrictions on overseas operations.

The Future

The invasion of newcomers, overcapacities at home and abroad, softening of prices, difficulties of finding new products and of holding a dominant position in the market long enough to pay off the investment in research and capital expenditures, all these things have meant trouble for the industry. Some of these problems will undoubtedly disappear as business booms and demand for chemical products continues to rise. There should be more and more new business for chemical companies as their synthetic products replace natural products. The chemical industry itself is a ruthless invader of other fields: plastics and chemical fibers and films of every sort are likely to make further incursions on the markets of paper, leather, wood, concrete, and metals. Professor Edwin R. Gilliland, chairman of M.I.T.'s chemical-engineering department, believes that the chemical industry may even take over most of the markets for building materials now supplied by stone, steel, and wood. Chemical producers will no doubt expand enormously into the field of synthetic foods, into insecticides and defoliants.

Yet there are also blocks to these advances. It will be a long, long time before plastics take the place of steel and concrete as structural building components. Unions and local building codes will continue to try to block new cost-saving materials. As consumer tastes develop, more and more people are likely to spurn synthetic products and demand the natural. And industries that are seeing their fields encroached upon are making their own responses. Textile manufacturers, for example, have devised chemical treatments for cotton that make this still indispensable fiber as crease resistant and fast drying as its synthetic competitors.

Meanwhile, chemical producers must, of course, go on adjusting to the traditional problem of their industry in which new products go on obsoleting older and profitable ones. This rapid obsolescence through new developments in inherent in the industry. So research that constantly uncovers new and better and cheaper products for the consumer has not only been the industry's greatest weapon but has also created problems.

In view of all the factors affecting it, the chemical industry for some time must conjure with shrinking returns on capital. The present upturn in sales should serve to stabilize prices somewhat and improve earnings, but these very improvements are likely to encourage new invaders and produce further mushrooming overcapacities. Last spring, when Dow's President Leland Doan saw Dow's sales figures for May, he happily announced that they were the highest in the company's history. "We are having a real recovery," he said. But he was not so optimistic about the return of handsome profits. "Overcapacity, and its effect on margins," he admitted, "continues to be a problem of perpetual motion."

Part Two

The Growth and Development of the Chemical Enterprise

At one time a chemical enterprise could find a profitable niche in the economy solely on the basis of its technical skills and resources. During this stage of the industry's growth, the emphasis was upon production. After all, if you were the only phenolic resin manufacturer in the northwestern United States, your main job was to maximize the output of the resin reactors—the plywood industry needed your product. Under such conditions, the ability to cut the batch cycle time from 18 hours to 16 hours was a valuable one. Similarly, the ability to, for example, design and operate equipment for high pressure and temperature reactions was sufficiently unique that its possession by an individual or a firm was often enough to guarantee a profit for the possessor.

Times have changed—the good old days are gone. It is no longer sufficient for either the individual or the firm to have excellent scientific knowledge, top engineering skills, a fortunate patent position, or a highly favorable raw materials position. Today, our phenolic resin producer in the northwest has a great deal of competition. Not only does his resin face competition from other polymers, phenolics and other types too, but his customer, the plywood manufacturer, faces competition from foamed polystyrene, particle board, honeycomb structures, etc. Thus, even if our resin manufacturer has diversified into ureas and melamines, he still faces the danger of seeing his market disappear via the obsolescence of his customer's product. Too, it is a lot simpler for other firms to compete with him. If these potential competitors have no adhesive knowledge, there are a multiplicity of sources for obtaining this knowledge.

Just as one nation passes another in the race to satisfy the market, so do individual enterprises compete. Take, for example, the chemical firms which are listed among the 100 largest nonfinancial corporations in the United States in 1960; these are given in Table 1. In 1950, in order to qualify for the listing, a firm needed minimum assets of 329 million dollars. Assets of such large magnitude would seem to imply that all the knowledge and talent needed to perpetuate the firm's position of eminence would be available and would be utilized. Yet this was obviously not so. In the past decade twenty newcomers joined the list while twenty powerful organizations were pushed out. The dominating position was by no means a secure one, rather, it had to be fought for and defended against the vigorous strivings of the competitive industrial organisms to adapt best in meeting the needs and wants of the market. Among the twenty new firms in this select group, eleven are in the chemical process industries—this is positive and dramatic proof of the dynamism and competition which exists in the chemical field today. Too, it should serve as a warning to those who are on the 1960 list (these need 698 million dollars of assets to qualify) that the list in 1970 will have some new names, that power is not enough, and that they must solve their marketing problems if they are to remain as healthy, vital industrial organisms.

The biological analogy to business organizations is a useful one. In nature, the organization (organism) which does not adapt to its changing internal and external environment will fail to survive. Successful adaptation, then, is the key to long-run achievement for the organism. Similarly, the chemical enterprise must recognize that it is doing business in a rapidly changing environment, that its needs and its customer's needs require constant reappraisal and development. Too, this environment is a hostile one, and the organizational response to changing needs must therefore be firm and energetic—token adaptation will result in the decay of the enterprise.

Table 1 Chemical Process Industry Firms Among the 100 Largest U.S. Nonfinancial Corporations — 1960[a]

Company	Assets (millions of $)
Allied Chemical Corp.	801
Atlantic Refining Co.	820
Cities Service Co.	1,343
Continental Oil Co.	833
Dow Chemical Co.	901
E. I. du Pont de Nemours	3,134
Eastman Kodak Co.	959
Firestone Tire & Rubber	850
Goodyear Tire & Rubber	1,037
Gulf Oil Corp.	3,843
International Paper Co.	977
Kaiser Alum. & Chemical	786
Monsanto Chemical Co.	1,090
Olin Mathieson Chem. Co.	860
Phillips Petroleum Co.	1,647
Shell Oil Co.	1,885
Sinclair Oil Corp.	1,487
Socony Mobil Oil Co.	3,455
Standard Oil of Calif.	2,782
Standard Oil Co. (Ind.)	2,926
Standard Oil Co. (N.J.)	10,090
Sun Oil Co.	766
Texaco	3,647
Tidewater Oil Co.	898
Union Carbide Corp.	1,713
Union Oil of Calif.	734

[a] This compilation from the list of 100 largest nonfinancial corporations does not include either public utilities or metals companies, some of which have substantial chemical operations.

The process of decay does not occur overnight when the firm fails to respond to any *one* market signal (external pressure). Rather, the process of decay (as in the biological organism) is occurring simultaneously with the process of growth; but, so long as the rate of growth exceeds the rate of decay the overall result is a successfully competing organization, one that will create jobs and opportunities for its employees, profits for its shareholders and value for society.

Vigorous survival then means that the firm must recognize that it must grow—that growth is the only way to combat decay. In the following pages some insight is given to the problems and areas of growth in the

CPI. First, the endurance of the product line is examined to illustrate the importance of growth. Then, some emphasis is placed upon a discussion of the various techniques by which a chemical firm can achieve growth.

Product Introduction and Survival

Estimates of the length of time in which a product exists in the marketplace are a frequently ventured, but seldom agreed-upon, figure. Rather than state the estimates in terms of years, a more meaningful statistic is that which indicates the survival probability, i.e., what is the chance that this product will be a commercial item five years from now? Some idea of this may be obtained from Tables 2 and 3. Compared to many industries, the chance of success for a product introduced to the chemical industry is relatively high (slight as it is). This is due, to a large extent, to the comparatively large size of firms in the chemical field as compared to all manufacturing organizations. The large size provides great resources of capital, management talent, and favorable corporate images—all of which makes it more difficult to fail. For smaller firms, the Small Business Administration reported recently that *more than 98 per cent* of the new products fail to survive the first two years (this is the failure rate for all manufacturing industries; the chemical industry data were not estimated separately).

The above attrition is suffered by products which have been introduced to the market on a commercially available basis. But, how many ideas

Table 2 The Life of the Product Line—Changes from 1945 to 1956

	Product Group		
Line Composition, %	*Consumer Paint*	*Industrial Paint*	*Pharmaceuticals*
Substantially the same	10	15	35
Basic products, but greatly improved	80	25	10
Products established, but new to the firm	0	0	45
Products new to firm and industry	10	75	10

The data are averages for 38 firms.
Source: *Sales Management Magazine.*

Table 3 The Life of the Product Line—Changes from 1959 to 1963[a]

Industry	*1963 Sales, Per Cent from Products Not Sold in 1959*
Iron and steel	10
Nonferrous metals	7
Electrical machinery	18
Chemicals	14
Paper and pulp	8
Rubber	7
Stone, clay and glass	9
Petroleum and coal products	4
Food and beverages	8
Textiles	9
All manufacturing	12

[a] Estimated.

New products are defined as items not produced in 1959 or products sufficiently changed since then to be reasonably considered as new products.

Source: McGraw-Hill Department of Economics.

must be born and rejected, how many products screened, tested, and developed, before even *one* product is introduced to the market? The Commercial Chemical Development Association has made an estimate of this; their estimate is given in Figure 1. Of every 540 ideas proposed for new industrial chemicals only one is introduced to the market on a com-

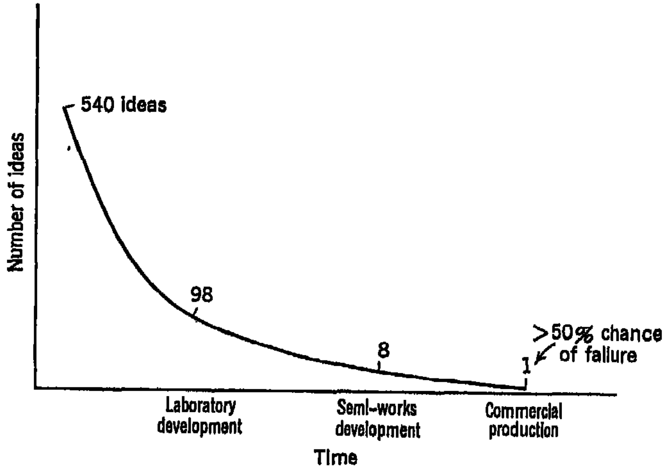


Figure 1. Decay curve of new product ideas.

mercial basis. And the success of this *one* product is subject to the onslaughts of competition, to the risks and uncertainties of the market, and to the managerial abilities of its exploiters.

Corporate Growth

The primary purpose of the papers collected in this section is to explore and illustrate the various ways by which a chemical firm can achieve "profitable" growth. The word "profitable" is emphasized because, too often, executives are found who think that an increase in sales automatically means an increase in profits. While this joint occurrence is frequent, it is not inevitable. Many times a decrease in sales will result in an increase in profits, e.g., through the elimination of unprofitable product lines; on other occasions an increase in sales will add no profit and may even decrease the firm's profit because, for example, of the greater marketing expenses required to obtain the sales increase. The emphasis throughout this section, then, is to examine paths to the growth of the chemical firm's *profits.*

The chemical industry has long been considered to be a growth segment of the nation's economy. As such, it meets the requirements of the general definition of a growth industry, i.e., one in which output, sales and earnings increase over a period of years at a rate well above the average for all manufacturing. The three yardsticks of a growth industry, i.e., production, sales and profits, will each be explored below for the chemical industry.

Production

The chemical industry's production has increased nearly three times more than that of all the average manufacturing industries in the period 1952–1961. Physical output of the chemical industry, as measured by the Federal Reserve Board's production index, showed an average annual increase of more than 7 per cent. The average annual increase for all manufacturing industries during this period was only 2.8 per cent. In terms of production, then, the chemical industry can be considered to be a growth industry.

Sales

During this same period (1952–1961) sales volume increased by 65 per cent. The sales increase for all manufacturing industries was considerably lower. Again, one of the criteria for a growth industry is satisfied by these data.

Profits

The after-tax profits of the chemical industry averaged 7.3 per cent of *sales* during this period. At the same time the average annual return for all manufacturing industry was 4.7 per cent of *sales.* When profits are measured with respect to another base, the difference is not so marked, but is nevertheless significant. Thus, the after-tax return of the chemical industry in the years 1952–1961 was 7.9 per cent of *investment,* while the return on investment for all industry was 5.6 per cent. The pretax earnings, as a per cent of sales, were 44 per cent higher for the chemical industry than for all manufacturing.

Profits, sales and production in the chemical industry all satisfy the requirements for the designation of "growth industry."

Conclusion

As has been shown in two of the previous selections (and will be illustrated in several more) this history of growth does not mean that the chemical industry can afford to be complacent. Although its profits are higher, its profit needs are greater than those of most industries. This greater need stems from the rapid rate of obsolescence which characterizes the chemical industry. This rate of obsolescence means that more funds are needed to replace existing facilities, processes and products. In addition, although the industry's profit rate is relatively high, it is not as high today as it was in the mid-1950's. Since that time there has been a steady erosion of the profit level as a result of increased competition and increased costs of labor and raw materials.

Responsible managers in the chemical industry have not been unaware of their industry's and their firm's needs to achieve profitable growth. As profits have declined they have stepped up their activities in search of greater returns. Some firms have found a profitable market in integrating forward to consumer products. Some firms have ventured into international markets, thus tapping a potential that can be quite rewarding. Still others have abandoned unprofitable items, merged with other firms, acquired companies or products, etc. Some chemical companies have used all of these techniques, plus several more, in their efforts to grow. In the fifteen selections which follow, the experiences of a number of chemical firms are presented. They do not merely serve as a record of what some companies have done; they provide insights into concepts and strategies which can be utilized by others.

It hardly needs to be emphasized that *profitable* growth and not just growth is the normal objective of CPI firms. But, herein lies the problem. In what fields are the companies' opportunities, what prices should be set, what channels of distribution should be used, how many pounds should be manufactured, when and how should the product be promoted, who are the customers—these are just some of the questions for which accurate answers are vital to the planned growth of the enterprise. It is the function of market research to answer them.

The following article takes an eclectic path through the varied duties and objectives of market research in the chemical process industries. By illustrating how market research has handled problems involving ammonium chloride, triple superphosphate, mercury, aluminum hydroxychloride, etc., the process and scope of market research is revealed. Particularly valuable in this connection are the many specific references to firms in the industry, to industry problems and to industry practices.

4 Market Research—Growth Ingredient for Chemical Companies

from Industrial and Engineering Chemistry

"We even talked to the farmers!" That's the way one chemical market research man at American Cyanamid summed up the completeness of a job he had just finished. Results of this survey led to Cyanamid's building of a multimillion-dollar triple superphosphate plant. Maybe the farmers' opinion wasn't the last word in deciding whether or not to build the plant, but it does demonstrate the lengths to which market researchers will go to get their information. Chemical market research is growing and the techniques are becoming refined as more and more practice the pro-

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fession. It is a tool which has become recognized by top management as necessary to their making decisions in a highly competitive and dynamic industry.

Chemical marketing research is the determination and evaluation of all pertinent facts concerning chemical markets and marketing for management decision and action. Actually, the activities performed vary from company to company, and are dictated by its needs, manpower, and internal organization. The cornerstone of marketing research is answering the question "What is the market for product X?" Related functions include sales forecasts, acquisition studies, and raw material studies.

There's a big difference between consumer and industrial marketing research. Consumer research has become a mathematical science. For example, 200,000 housewives are asked if they prefer red or green, and their answers are then fed through tabulating machines and are cross tabulated numerous ways. The results are then sent to an office of statisticians who by using long and complicated statistical formulas arrive at percentage answers that X number prefer red, Y number prefer green, and Z number have no choice. In other words, ask enough people the same question and by direct extrapolation arrive at the answer for the entire population.

Industrial marketing research, of which chemical marketing research is one segment, is not defined by mathematical equation. Most workers still define a market by asking many questions of a few companies and then extrapolating the answer from their own knowledge of the field. Mathematical equations won't do this. In many cases there are fewer than a dozen predominant consumers of any one chemical; thus all facts must be weighed in the light of the probable future action of this dozen, each of which is likely to move in a radically new direction—causing their consumption to become nil or a 100-fold.

Managements usually ask how much of a specific chemical will be consumed in any 1- to 10-year future period. As the chemical industry is dynamic and technological changes are constantly occurring, the chemical market researcher is more concerned with what is happening in the laboratory today than how many pounds were consumed yesterday. Of the millions of chemicals in use, very few have a long history of tonnage consumption. Production and consumption figures are extremely scarce and it is rare when the chemical market researcher can obtain an historical series which can be extrapolated. When the researcher is so fortunate, the normal method for extrapolation of chemical production data is by visual inspection of the curve rather than by trying mathematically to fit a trend line.

American Cyanamid's Survey on Triple Superphosphate

Survey Results

Consumption of phosphorus pentoxide in fertilizers increased from 1,354,000 tons in 1945 to 2,227,000 tons in 1954. Estimated 1960: 2,800,000 tons.

Total fertilizer phosphorus pentoxide supplied by triple superphosphate increased from 8.3% in 1945 to 23% in 1954.

In terms of triple superphosphate containing 45% available phosphoric acid, consumption went from 250,000 tons in 1945 to 1,200,000 tons in 1954, or *a 380% growth compared to the 57% growth of phosphorus pentoxide* during the same period.

Present demand: three fourths used in mixed fertilizers; two thirds consumed in north central regions; one third used captively by producers.

Future outlook for triple superphosphate: 2,300,000 tons by 1960.

U. S. triple superphosphate capacity almost doubled in 1954 with 700,000- to 800,000-ton-per-year expansion. Beginning of 1955, there were sixteen producers with capacity of 1,800,000 tons per year. About 70% of capacity located in Florida.

Demand estimated to catch up with present installed capacity by 1960. For the three plant sites under consideration, Brewster, Fla., appeared to offer best opportunity to Cyanamid.

Action Taken

Management approved an appropriation to cover cost of design and engineering of a triple superphosphate plant to determine the total capital investment required.

Marketing and economic information presented before the company's general staff and board.

Multimillion-dollar capital investment approved by K. C. Towe, president (new chairman of the board), on December 20, 1955.

Plant construction started April 1956, and first batch of triple superphosphate produced May 30, 1957. Capacity of plant: 200,000 tons-per-year. Product trademark: Trebo-Phos.

How Survey Was Made

From within the company through contact with sales, economics, research, and other personnel.

Published literature and government agencies.

Field trips to fertilizer manufacturers and dealers, state agronomists, USDA Extension Stations, and even farmers.

Where Are We Now?

The question might be asked, "How does market research get started?" There are several answers, but the most important is profit. X Chemical Co.'s profit picture has not been so good for the last several years and the investors are interested in making money as well as chemicals. What can be done to improve the profit picture? Several things. One might be to diversify. Another might be to buy another chemical company that is making money, while still another might be to quit making marginal profit items. No chemical company can do any of these without market research.

When a company has such a problem, it must hire market research men, go to a consulting firm, or throw the problem in the laps of its existing market research department. If the company already has such a department, one of the best starting points is to conduct a preliminary soul-searching survey to compare its growth with that of the chemical industry. The major problem in this type of study is how to compare actual growth. Dollar sales are frequently used as the common denominator, but they must be corrected for inflation and price reductions so that the statistics can be reduced to physical growth—how many tons of chemicals were produced and profitably sold. While physical volume is a much truer measure of growth than is dollar sales, perhaps the most realistic approach to the problem is that of value-added-by-manufacture as a per cent of sales. Value added as defined by the Bureau of Census is the value of goods shipped (sales) less the value of supplies, fuels, electrical energy, and materials costs.

Forecasting sales of a company is another problem related to measuring its growth. The trick is to get determining indicators, which can be forecast, that lead the sales of X Chemical Co. by several months so that in turn the sales of that company can be forecast. One approach is finding a curve with the same characteristic as X company's total sales curve is to plot X company's sales with the Federal Reserve Board production indices and chemical industry sales. These indices are considered among the most reliable general business indicators and have widespread use for sales analysis. At first, it may seem meaningless to compare production with sales. But comparison can be made by eliminating price changes and converting sales dollars to an index.

The job of forecasting is really one of trend and cycle analysis. It is not a solution, but the elimination of the obvious. Most curves, which can be devised to forecast an individual company's sales, are constructed as a composite of several unrelated statistical series, each of which is readily available and forecastable. In many cases, the indicators which can be used are found by pure chance and hard work of eliminating series after series.

Where Do We Want to Go?

Once the management of a company understands the position of its company relative to the position of similar companies and the chemical industry as a whole, it is in a better position to take action. Consider a case history. The Y Chemical Co., which manufactures chemicals containing mercury, decides to buy a mercury mine. Chemical market research provided the basic information on which management can make its decision. A report was prepared on the world supply and U. S. demand for and price listing of mercury metal. Market information was developed from publications and personal contacts. A summary of the market research report is seen in the "Report on Mercury" below.

Report on Mercury

Long-trend world mercury production is upward, while the long-trend United States mercury production is downward.

Italy and Spain are the principal producers; the United States accounts for only about 10% of the world production—an average of less than 20,000 flasks per year.

Average mercury yield in the United States is 0.5%, in Italy it is 1%, and in Spain, 4%.

Labor is reported to be half of the mining cost and the break-even point is reported to be $175 to $200 per flask.

There are 11 principal mercury mines in the United States which average more than 100 flasks per month. California produces more than half of the United States' mercury. Nevada is second and Alaska is expected to replace Oregon as the third largest producer.

Use of mercury in electrical apparatus, economic poisons, control instruments, and electrolytic cells is increasing. Use of mercury in catalysts and pharmaceuticals is decreasing. The market for redistilled mercury is remaining steady.

Approximately 600,000 pounds of phenyl mercuric acetate and 150,000 pounds of phenyl mercuric oleate were consumed in 1954, principally in economic poisons, approximately 825,000 pounds of mercuric chloride were produced in 1943, principally for use in pharmaceuticals, and approximately 95,000 pounds of mercurous chloride were produced in 1953 for use in pyrotechnics, veterinary products, and as a reagent.

Mercury metal has shown a long trend, average price increase from $50 per flask in 1900 to $140 per flask in 1950 with 9- to 17-year cycles.

Mercury reached a low of $76 per flask in 1948 and rose to $279 per flask in 1955. The price is expected to drop below $100 per flask between 1965 and 1970.

Reported minimum economical production of a mercury mine is 1200 to 2000 flasks per year or less than 5% of the total market.

The only potentially large new use for mercury (as mercuric oxide) is in a special miniature battery. This market has not grown because of the relatively high cost of the battery. An electronics company recently has shown interest in this application for television receiving sets.

This is one of the toughest problems thrown at marketing research sections—a raw material solution. The only clear-cut way to arrive at an answer is by using the interest method of return-on-investment. In addition to calculating the return which a company will realize from money expended to purchase a mine or oil well, the market researcher must also consider such questions as where is the raw material going on the competitive market, is it one produced by many people, or is a new, cheaper source likely to be available soon. Based upon all the facts available in this case, recommendation was made that the company buy a mercury mine.

Another job of market researchers is to advise management of the feasibility of manufacturing additional products. One chemical company thought it might make a nice profit on manufacturing ammonium chloride, U.S.P. A study was made to determine the market for this material and the share of the market which the company might reasonably expect to obtain. Just how complete and detailed was the job done can be seen from the final report:

Summary

Estimated Annual Consumption of Ammonium Chloride, U.S.P., Is:

Application	*Pounds*
Diuretics	330,000
Expectorants—ethical	120,000
Expectorants—proprietary	120,000
Other pharmaceuticals	20,000
Export	10,000
Miscellaneous	50,000
Total	650,000

Detailed Findings

Applications

Ammonium chloride, U.S.P., finds principal application in the pharmaceutical industry. Its therapeutic uses are: as an expectorant; as a diuretic to induce incipient acidosis in order to effect diuresis or calcium mobilization, or to offset alkalosis; and to supply plasma chloride in edema.

1. *Expectorant use.* Expectorants are drugs which produce more abundant secretions from the respiratory passage by making the sputum less viscous, causing coughing to be more productive.

Ammonium chloride in small doses receives extensive application as an expectorant in the symptomatic treatment of coughs and bronchitis. It is variously maintained to depend on the reflex bronchial secretions elicited by the mild gastric irritation or on the water intake prescribed with the cough preparation containing salt. The saline taste is often disguised by the use of sirup vehicles such as cherry sirup. In addition, sirups will display a direct demulcent action on irritated pharyngeal tissue. In place of simple sirups, elixir of terpine hydrate, and sirups of citric acid, acacia, orange, tolu, etc., are also employed and other drugs may be added including sedatives and anodynes (including opium alkaloids). Irrespective of the vehicle, drinking a glassful of water for each dose of ammonium chloride may be prescribed.

Other drugs exhibiting expectorant action include potassium glycol sulfonate, ammonium carbonate, ammonium acetate, potassium citrate, potassium iodide, creosote, terpine hydrate, and wood tars.

2. *Diuretic use.* Salts which tend to produce acidosis are effective diuretics. The most widely used are ammonium chloride, ammonium nitrate, and calcium chloride.

Ammonium chloride is readily absorbed from the gastrointestinal tract and is converted by the liver into urea with concomitant reduction of the alkaline reserve. This incipient acidosis induces diuresis.

Because doses of ammonium chloride, sufficient to produce effective diuresis (from 4 to 8 or 12 grams daily), produce gastric irritation—as evidenced by nausea and vomiting—the compound is usually administered in the form of enteric-coated capsules or tablets.

In recent years, there has been significant clinical interest in the parenteral use of ammonium chloride to mobilize calcium ions, especially in cases of severe alkylosis. For such use, ammonium chloride is often formulated in a sterile, normal saline or a 5% dextrose solution.

Ammonium chloride may be employed to advantage as a source of plasma chloride and as a diuretic in those edemas accompanied by an especially low plasma chloride content.

3. *Other uses.* Ammonium chloride, U.S.P., is also used to a lesser extent as a settling agent in the phosphor coating of television tubes, as a catalyst for urea-formaldehyde resins in textile finishing, as an ingredient of photographic emulsions, and as an anticaking agent for flour.

Markets

Ammonium chloride, U.S.P., finds major use in the pharmaceutical industry—principally as an expectorant and diuretic. Minor markets include the photographic, food, electronic, and textile industries.

1. *Expectorants.* Ammonium chloride is contained in about 20% of the expectorants currently marketed. These preparations are offered both as ethical and proprietary formulations.

Consumer preference is based on physician's prescription or over-the-counter choice as influenced by marketing and promotional efforts rather than therapeutic value. The market size has been estimated—in the absence of published production statistics—from dollar volume and brand preference studies.

United States sales of cough sirups, elixirs, and expectorants in 1955 are estimated to be $55,000,000 (Table 1). Sales are believed to be divided—$33,000,000 ethical and $22,000,000 proprietary—volumewise, the division is probably 50-50. In addition, $30,000,000 worth of cough drops, lozenges, troches, and gums were sold plus $2,000,000 exports of cold, cough, and bronchial preparations.

Table 1 Four-Year Look At United States Sales and Exports of Expectorants[a]

Group	*Sales and Exports by Year, $1,000,000*			
	1955	*1954*	*1953*	*1952*
Sales				
Cough sirups, elixirs, expectorants	55.3	51.8	52.6	50.5
Cough drops, lozenges, gums	30.2	29.1	29.3	30.0
Exports				
Cold, cough, and bronchial preparations	2.3	1.9	1.9	1.9
Total	87.8	82.8	83.8	82.4

[a] Sources, Drug Topics Publishing Co. and U. S. Exports, FT 410, Part II Bureau of the Census.

Total consumption of ammonium chloride, U.S.P., in expectorant preparations is estimated to be 240,000 pounds.

a. Ethical preparations are sold only by prescription price. Estimated consumption of ammonium chloride, U.S.P., in ethical cough preparation is 120,000 pounds.

b. Proprietary preparations are sold over-the-counter without a prescription requirement and at a lower price than ethical preparations. Estimated consumption of ammonium chloride, U.S.P., in proprietary cough preparations is 120,000 pounds (Table 2). Included are cough sirups, elixirs, cough drops, lozenges, troches, and gums.

Table 2 Estimated 1956 Consumption of Ammonium Chloride, U.S.P.

	Consumption Pattern, Pounds		
Producer	*Proprietary Cough Preparations*	*Ethical Cough Preparations*	*Diuretics*
A	20,000	25,000	84,000
B	20,000	20,000	40,000
C	8,000	12,000	20,000
D	10,000	10,000	18,000
E	10,000	6,000	15,000
F		6,000	15,000
G			12,000
H			11,000
I			10,000
J			8,000
Others	52,000	41,000	97,000
Total	120,000	120,000	330,000

2. *Diuretics.* Ammonium chloride and other acid-forming salts including ammonium nitrate and calcium chloride have only limited value as primary diuretics. Their chief importance is for use in combination with mercurial diuretics—producers are listed in Table 3.

Table 3 Producers of U.S.P. and Sal-Ammoniac Grades of Ammonium Chloride

Producer	
Ammonium Chloride, U.S.P.	*Sal-Ammoniac*
J. T. Baker Chemical Co., Phillipsburg, N. J.	Du Pont, Indiana, Ohio
Croton Chemical Co., Metuchen, N. J.	Penn Salt Mfg. Co., Wyandotte, Mich.
General Chemical Co., Marcus Hook, Pa.	Solvay Process Division, Allied Chemical & Dye Corp., Solvay, N. Y.
Mallinckrodt Chemical Works, St. Louis, Mo.	American Cyanamid Co., Bound Brook, N. J.
Schuylkill Chemical Co., Philadelphia, Pa.	

3. *Other pharmaceutical applications.* Small amounts of ammonium chloride, U.S.P., are used in a legion of products. Total consumption is estimated to be 20,000 pounds by more than 100 producers. No attempt has been made to track down each individual use because the customers are principally the same as those for diuretic and expectorant applications and their production of other ammonium chloride containing products is small and even changing.

4. *Minor markets.* Approximately 92% of the United States' consumption of ammonium chloride, U.S.P., is in pharmaceutical products—the remaining 8% (50,000 pounds) finds many diversified uses; some of which are:

a. Photographic film producers find limited application for ammonium chloride, U.S.P., as an ingredient in paper emulsions, though most of them have found that the alkali chlorides do a better job. Estimated market is 5000 to 7000 pounds.

b. Electronics uses 10,000 to 12,000 pounds of ammonium chloride, U.S.P., annually as a settling agent in coating television and fluorescent tubes with phosphors. Each company has its own preferred settling agent, depending upon the chemical composition of their phosphors. Another 2000 to 3000 pounds annually of ammonium chloride, U.S.P., are used in conjunction with zinc chloride to make a special solder for Electronics Co's own use. No other electronics manufacturer is using ammonium chloride for this application.

c. Textile resins use about 12,000 pounds annually of ammonium chloride, U.S.P., in a specialty product. U.S.P. grade is used to obtain good color control. Ammonium chloride has found use as a catalyst for urea-formaldehyde finishing resins, but U.S.P. grade is not known to be used by any other producer.

d. Flour manufacturers use 5000 to 6000 pounds of ammonium chloride, U.S.P., annually as an anticaking agent for export shipments of flour.

The case history illustrates the problem of the chemical market researcher having to forecast the market for consumer products by brand. Statistics readily available deal with the total dollar sales of these products. The problem therefore is to translate dollar sales into pounds. On the surface, this problem may seem elementary; in practice it is rather complex. Without spending vast sums of money in extensive research, the best average can usually be determined by taking the fair trade price or manufacturers suggested price and converting that for each of the major brands to the average dollar per pound. To this is applied a factor to account for special deals and cut rate prices prevalent in the consumer industry. Then by using various consumer-use and brand-preference studies, it is possible to arrive at an estimate of pounds produced. At best, final answers are a rough "guesstimate," which after checking by field interviews with various potential customers can be used for forecasting purposes. Studies of this type also lend themselves to the mail questionnaire technique.

In dealing with consumer products, more than one approach should always be taken in estimating the size of the market. One chemical manufacturer making aluminum hydroxychloride complex for a cosmetic firm surveyed the open market and found that by using the population approach, the size of the deodorant and antiperspirant market was about 19,100,000 pounds. This estimate was arrived at from data which indicated that the market was composed of 88.6% of the women and 55.6% of the men over age 15, each consuming about 4 ounces per year. However, when the retail sales approach was used, the total market was found to be only 10,400,000 pounds. The detailed breakdown of aluminum hydroxychloride complex usage based on the over-all market size is presented below. In cases like these, it is the market researcher's responsibility to evaluate the answer from each approach and use the one, which in his best judgment, gives a truer answer. In this case, the market researcher chose the figures from retail sales as being more nearly representative of the true figure.

Use Pattern of Aluminum Hydroxychloride Complex

1. Antiperspirant preparations marketed in 1956 are estimated to have contained about 1,200,000 pounds of chemicals as astringent agents.
2. Aluminum hydroxychloride complex accounted for about 620,000 pounds and aluminum hydroxychloride—lactate complex for about 400,000 pounds. Other aluminum salts and zirconium oxychloride accounted for most of the balance.
3. About 75% of the estimated market for aluminum hydroxychloride complex (465,000 pounds) is consumed by five manufacturers. About fifteen other cosmetic companies account for another 15%, and several score smaller formulators consume the balance.
4. Aluminum hydroxyperoxide—lactate complex—only recently available—is finding favorable use in stick deodorants and possesses more desirable properties than aluminum hydroxychloride complex for these applications. The lactate complex is displacing aluminum hydroxychloride in some stick preparations, and is competing with the latter in other formulations.
5. Manufacturers are continuously reformulating and publicizing the merits of new "active" astringents. Personal preferences, as influenced by package or dispenser appeal, change markedly over a short period of time, so that the market is constantly fluctuating.

Market Research Several Steps Removed

Not all market research activities in chemical companies are concerned with the immediate market for their product. Du Pont makes polyethylene but it doesn't injection-mold the finished articles. However, the company must still know what the market may be for certain injection-molded items so that in turn, the market for polyethylene resin can be predicted. This is one of the jobs of the marketing analysis section of the company's polychemicals department. It is done by comprehensive end-use analysis, principally through a field sales organization which gathers information through customers to determine the ultimate end use and the marketing channels involved. To relate this information to size of opportunities, detailed studies in the specific end-use areas are made. With plastics, for instance, the extent to which a certain plastic will be used is determined from a detailed analysis of the over-all economics of the use of the material in comparison with other materials that are also suitable. With this approach, a great deal of emphasis is put on new product areas. As a result, there is little or no existing use information other than that demonstrated in the early stages of the development of the product. However, the product is handled in the marketing analysis in exactly the same way as a product for which use information is available.

Brush Fires

While chemical market research plays a big role in some of the more glamorous and obvious developments in chemical companies, it is also the unsung hero in improving a company's profit situation in its own backyard. Frequently manufacturing equipment may be used only 3 days a week. If the right product can be made in this equipment the other 4 days, the company will be operating more efficiently. However, the two words, *right product,* must be stressed. The profit margin or manufacturing difficulties with certain other products may be such that it would be cheaper to have the equipment idle for 4 days a week. In handling this kind of local problem the market researcher usually talks to someone "in the know" in the plant and from these conversations develops a list of 50 to 60 chemicals which can be made in the idle equipment. Then by a process of elimination, based on such factors as unfavorable price situation and poor demand, the list is narrowed down to five or six chemicals. A market survey, similar to the types mentioned earlier, would further narrow the list to one or two products.

Similar to the brush-fire type of market research work is determining *whether to continue or discontinue manufacturing of small volume chemicals.* Davison Chemical Co. was making an anhydrous silica gel for a customer who bought it in 500-pound lots. Each time an order came through for 500 pounds, the company lost about 1500 pounds in meeting the customer's specifications. Complicating the situation was the fact that the customer was using the silica gel in fulfilling a government contract on which he had quoted a certain price, making it difficult for the chemical company to raise its price on the item. The chemical market research department eventually spotted the practice and recommended eliminating the product from the company's line.

Other work, which eventually must be taken over by market research, is the evaluation of how much chemicals to stock where, how many salesmen to handle sales in various areas, and how many warehouses and where. A few companies now have market researchers on these problems, but in most, the market research staff is too small and the staff too busy with the type of market research described earlier in this article. Says one market researcher, "We'd like to tackle some of these things now, but we have neither the time nor the manpower."

Special Techniques

In the United States, chemical market research can discover or observe specific sales possibilities or marketing channels amidst the complex structure of the known needs and requirements. Suppose, however, that a chemical company decides to expand in another country—say in Latin America. In certain Latin American countries, change and progress are much more rapid than in this country. The reason is that there is a driving demand on the part of the people to enjoy the better things in life. The market researcher must probe more deeply into underlying economic structures. He must combine his commercial know-how with a broad knowledge of economic fact and theory in developing special techniques for evaluating markets. One of the most successful companies in developing such special techniques has been W. R. Grace & Co. While some of the information developed by Grace's market research may appear visionary, by contrast to market research for a product in this country, it is not. The company estimates the population in Latin America is increasing at the world record level of 2.4% a year compared to our record rate of 1.6%. At the end of 1955, the population of Latin America was estimated at 168,000,000. But by 1975, it is expected to be 280,000,000, compared to our own anticipated population of 203,000,000.

In addition to recognizing and interpreting the effect of social and economic trends on a new product or business, the market researcher in a foreign country has to be on the lookout for increased tax benefits, guarantees, tariff protection, and other moves which could affect the price of his product. He must also know the business pulse of the country in which he intends to establish a business. For instance, Latin America's gross national product is increasing at the average rate of 4.4% per year, compared to our own impressive rate of 3.2%. Also, local production has made impressive gains, especially in heavy industrial chemicals. Sulfuric acid output of 340,000 tons in 1954 was almost large enough to meet domestic needs and imports ran less than 1% of total use. While the caustic soda output of 70,000 tons met only 30% of 1954 needs, production is now up 63% over 1954. Production of soda ash doubled in the same time, and a new plant in Brazil will increase output by six times its current level. In the smaller countries of South America, as on the West Coast, it is doubtful that large scale markets for industrial organic chemicals will justify local production in the foreseeable future, except under very special conditions, as for export.

Grace's market research department, experienced at eyeing chemical business in Latin America, feels that the following principles hold true for any chemical company contemplating a plant in a foreign country:

Select activities which are a basic part of the national economy.
Stay away from local political affairs.
Use nationals in management.
Use local capital in enterprises.
Take part in local community life.
Avoid building up a dominating position in the economy of any particular country.

Acquisitions

One of the ways for a company to grow is to diversify. And one way to diversify is to acquire other companies. Several large chemical companies have market research groups studying situations and companies which might be considered as acquisition possibilities. There are several reasons why chemical companies are looking hard at acquisitions. It permits relatively rapid growth without the need for a heavy investment in research effort; it does not generate additional production capacity at a time when the industry's requirements are amply satisfied by present facilities; and it's a way to get top managerial talent. While some chemical companies prefer the internal development method of growing, especially in the light of the U. S. Supreme Court's crackdown on mergers, considerable emphasis will continue to be placed upon acquisitions.

For this reason, many chemical companies have come up with elaborate systems for accurately appraising potential acquisitions. (See outline on page 65.) Such questions as what are the hobbies of key personnel, what basic patents does the company hold, or what is the effect of government controls on sales of the company's product often come up before a final decision is made.

The actual filling in of the form is almost mechanical, but it often takes a long time to obtain the information. The most difficult part of an acquisition rating is getting management to state a score which is acceptable. Many of the facts required to rate a company in detail must be obtained by conference with representatives of the company under consideration. However, a form such as this provides a uniform method for evaluation and can be used very successfully for preliminary screening. In this case, the known information is rated and the unknown is given a range or is "guesstimated." In either case, situations which do not measure up to the standard set by management are eliminated.

Same Purpose—Different Methods

While the purpose of market researchers in chemical companies is generally the same—to point the way to increased profits, the way in which individual market researchers operate may vary quite a bit. The market research manager of one large chemical company reported that he gets more information over the telephone than he could in direct interviews. A researcher in another company reported that he spends about 90% of his time in the field, getting information. Still another spends half his time in his office and the other half traveling. Differences of opinion, too, exist among market researchers over the exchange of information. One leading chemical company looking into the possibility of buying a Texas firm compiled a comprehensive report on that firm's activities. However, the management of the chemical company decided not to go ahead with the acquisition. Another company interested in buying the same Texas firm heard of the first chemical company's interest and subsequent decision not to buy and offered $25,000 for the first company's market research report. The report was sold. Said one field man in New York, "We would have given the report away because there may come a day when we may want this same kind of information from the company to whom the report was sold." Another field man said that this was unusual and not common practice. Few market research men will admit that in their search for information they'll occasionally invite someone out for a cocktail or two, or wheedle information over dinner. The chairman of a national market research meeting once said, "Now boys, let's adjourn to the lounge and exchange confidential information." This turns out to be more truth than fiction. Market researchers are changeable, too. One man discussed his company's recent acquisition of another chemical company freely over the phone one day and the next day refused to discuss it at all.

Pharmaceutical Market Research

In the bustling drug industry, the scope of market research has never been wider. The work ranges from interviewing doctors to taste-testing, from package design trials to assessing the tempers of sick beef cattle. The market researcher can never predict what he will be asked to do tomorrow because it's impossible to tell what tomorrow's drug will be like. Who would have thought a year ago that tranquilizing drugs would be given to cattle?

The most important question which must be answered by pharmaceutical market researchers is, "What is the ranking of each of the major markets and where do the opportunities exist in each?" Are they growing as are tranquilizers and antinauseants, or are they holding even like vitamins, or are they declining along with hematinics. The question is answered by blocking out by rank those market areas which present the major opportunities for product success.

A good example of a success story of market research in the pharmaceutical industry was Chas. Pfizer & Co., Inc.'s marketing of Sigmamycin. By late 1955, Pfizer's research had come up with a new concept of antibiotic combinations to achieve a broad spectrum of activity not possible with the then available antibiotics. Apparently, here was a major development, but many questions had to be answered before it could be translated into a commercial product. How did Pfizer's results jibe with problems faced by physicians? Which combination of several should be marketed? What type of advertising should be used? To answer these questions and others, almost 400 physicians were surveyed. The results of the survey were analyzed, which gave Pfizer guidance in the final selection of a product, and the preferred promotional theme. Sigmamycin, Pfizer's brand of tetracycline and oleandomycin, was marketed in late 1956, and ushered in the "Third Era of Antibiotic Medicine."

Market research in a drug company has its novel twists. The company must think about making its product acceptable (and if possible, even welcome) to patients, especially children. Pfizer has set up a taste-testing section, three taste panels, whose job it is to select flavor and color of new drugs. As many as a dozen of these tests may be made on a single drug and pediatric flavors are selected by a special children's panel. The company never has had any difficulty in getting volunteers for these panels, and once was swamped with requests to get on such a panel when it was studying the effect of antioxidants on the taste of beer. Even the question of animal acceptance of a product is of concern. While Pfizer doesn't have a taste panel for farm animals, it may not be long before it does.

One market researcher in the pharmaceutical industry, getting his crystal ball out, predicts that the drugs business will grow faster than the chemical industry in 1957. Pharmaceutical sales for 1956 were about $2.2 billion against $1.9 billion for 1955—up 14%. This outstripped chemical industry sales—up only 4% on $23 billion in 1955.

Appraising a Company before Buying

Summary of Factors Rated

Criterion	*Weight Factor*	*Rating*
Total of weight factors and rating		*1.00*
I. Marketing		0.34
A. Growth potential	0.12	
B. Markets	0.05	
C. Price structure	0.04	
D. Effect on our present sales	0.04	
E. Competitors	0.03	
F. Distribution methods	0.02	
G. Sales integration	0.02	
H. Advertising & sales promotion	0.02	
II. Financial		0.30
A. Per cent return on investment	0.20	
B. Annual sales	0.03	
C. Vertical integration	0.03	
D. Investment required	0.02	
E. Tax shelter	0.02	
III. Relations		0.14
A. Key personnel	0.05	
B. Labor relations	0.05	
C. Product's appeal to investors	0.04	

Appraising a Company before Buying (Continued)

Summary of Factors Rated

Criterion	*Weight Factor*	*Rating*
IV. Manufacturing		0.10
A. *Product load*	0.04	
B. Raw material supply	0.02	
C. Know-how	0.02	
D. Plant facilities	0.02	
V. *Research and Engineering*		0.07
A. Technical achievement	0.05	
B. Know-how	0.02	
VI. Legal and Corporate		0.05
A. Patents and know-how		
1. Coverage	0.02	
2. Duration	0.01	
B. Government controls	0.02	

An Example of How Each Factor Is Rated in Detail—Marketing

A. Growth Potential—In which growth stage are the enterprise's principal products or markets?

Growth Stage	*Scale*	*Score*	*Factor*	*Rating*
Decline	0		×0.12	
Stability	33.3			
Normal development	66.6			
Early; or new, following stability	100			. . .

B. Markets—How many different major consuming industries use the enterprise's products? This reflects two other important factors—sensitivity to business conditions and seasonal fluctuations.

Consuming Industries	*Scale*	*Score*	*Factor*	
Number of industries:				
1–2	0		×0.05	
3–4	40			
5–6	80			
7 and over	100			. . .

C. Price Structure

Type	*Scale*	*Score*	*Factor*	
Cut-throat	0		×0.04	
Fluctuating; profit uncertain	50			
Stable; long range profit likely	100			. . .

D. Effect on Our Present Sales—Reciprocity, etc.

Effect	*Scale*	*Score*	*Factor*	
Adverse	0		×0.04	
None; or if existing product is obsoleted, approx. equal return-on-investment is realized	50			
Moderately aided	75			
Greatly aided	100			. . .

E. Competitors—How many engaged in, or known to be entering the field: (Include only those which have, collectively, about 90% or more of the total market.)

Number	*Scale*	*Score*	*Factor*	
Over 20	0		×0.03	
20–11	33.3			
10–4	66.6			
3–0	100			. . .

F. Distribution Methods—How are enterprise's products marketed?

Channel	*Scale*	*Score*	*Factor*	
Principally through agents and jobbers	0		×0.02	
Own sales force, agents, and jobbers	50			
Principally through own sales force	100			. . .

G. Sales Integration—What is the relationship between our accumulated selling know-how and the selling know-how required to dispose of the new enterprise's products:

Relationship	*Scale*	*Score*	*Factor*	
Poor	0		×0.02	
Fair	50			
Good	100			. . .

H. Advertising and Sales Promotion

Effectiveness	*Scale*	*Score*	*Factor*
Below average	0		×0.02
Average	50		
Above average	100		
			Total

Chemical Equipment Manufacturers' Unique Position

One of the most remarkable things about market research in the chemical equipment manufacturing industry is the lack of it. Most equipment manufacturers have no formal market research section but depend mostly on salesmen for market information. Standard items offer inventory problems, but the company can usually tell by past experiences what should be stocked, how many, and where. Other companies don't need a market analysis—the problem is making enough to meet the current demand. The Eimco Corp., for example, makes specialized filter equipment and can hardly produce fast enough to keep up with demand. The company has a small staff concerned with market research, but their activities are directed at satisfying the specific needs of customers. The Pfaudler Co. in Rochester, N. Y., maintains a one-man staff, which necessarily limits the depth and scope of the company's market research.

Occasionally an equipment manufacturer needs market information when it is considering a special situation. Graver Tank & Mfg. Co., Inc. (now talking merger with Union Tank Car Co.) was considering making storage and transporting tanks for anhydrous ammonia, used as a nitrogen fertilizer. The liquefied ammonia was an immediate success when it was introduced in Mississippi in 1947 and its use gradually spread to the Midwest corn belt. By the spring of 1954, considerable interest had been generated in Graver's normal marketing area. The company had built tanks for the purpose before, but always on a custom basis. If this was to be a volume market, production line methods were necessary. Certain factions of the company favored launching such a program immediately because the prospects looked so good. Other more conservative elements insisted on obtaining market information before proceeding. For this reason a market research project was undertaken.

The company wanted certain basic elements of information:

Acceptance of this form of fertilizer by the farmers, giving some idea of the short and long term market trend
Locations of competitors
Total potential market for anhydrous ammonia
Amount of storage required to handle this probable market
Competitive prices that had been established on tanks

The information was obtained mostly by personal interview. A large percentage of the ammonia dealers selling to farmers in the Midwest were interviewed. All of the manufacturers of ammonia east of the Rockies were contacted and statistical information was collected. As a tempering factor, the company contacted a number of dealers and manufacturers who were interested in other types of nitrogen fertilizer in competition with ammonia.

Long before the interviewing was completed, certain definite patterns were developing. The price structure on the tanks had become distressed to the point that the company could not expect the profit margin which was considered normal for its products. On the basis of this report, the company decided not to manufacture ammonia tanks on a production line basis.

Equipment for Equipment Manufacturers

One of the most difficult jobs of market research is the industry which must supply the materials of construction for the chemical process industries and the equipment manufacturers—the steel industry. Not only must the needs of the immediate consuming industry be anticipated, but a knowledge of the economic facts of life of the chemical industry is also necessary. Called commercial research, in the steel industry, and not market research, the job of studying markets is perhaps one of the most exacting marketing jobs anywhere. Consider a specialty steel manufacturer which makes plate steel. The first job which must be done is to make a forecast of the total market for plate steel. One market analyst in a company producing plate steel said that he gets his forecast by reading the *New York Times, Wall Street Journal,* all local newspapers, about 50 magazines and journals, in addition to traveling about 50% of the time and making personal contacts within industries using plate steel. The forecast is made from this reservoir of information and broken down into specific markets. The company may want to know what the total market is for clad steel in the chemical process industries. Again a market study is made and a figure arrived at, say 50,000 tons. The company then asks the question, "How much of that market does it want or can it get?" This is where profitability enters into the picture, and profitability is determined by the type of steel produced. Therefore, still another study must be made to show how much of the different types of plate steel go into making up the total market of 50,000 tons. Plain carbon steel, for instance, may have a profit margin of only 3 to 5%. On the other hand, high temperature alloy steel may have a profit margin of 15 to 20%, so the company will try to get a big chunk of this market. How seriously do the steel companies take such forecasts? Dead seriously. For example, the Lukens Steel Co. is spending $33,000,000 for expansion based on an optimistic forecast.

Aside from long-range forecasting, and its effect or impact on how much of and which markets to go after, suppliers of steel for the chemical process industries operate like the corner drug store, as the forecaster for one steel company puts it. They keep a certain amount of specialty materials on hand, but for the most part, they wait until they get an order before going ahead. The business is somewhat complicated, as the price of fabricated steel is dependent on the price of scrap iron and steel. Guided by commercial research, a steel company may decide to go after a certain segment of the market and actually contract to supply some materials. Then the price of scrap metal might change and the profit situation could change overnight.

Conclusion

No one can predict the future precisely and few market researchers will try to make any claim for doing so. However, chemical market research can supply definite identification and estimate, quantitatively, the factors which will affect the company's business tomorrow. With this help, management's hunches can be transformed into calculated risks, with the odds in the company's favor. Market research may sometimes be expensive, but as a vice president in charge of commercial development of one chemical company puts it, "We couldn't afford not to have it."

A great deal of publicity has attended the introduction of a host of new polymers, propellants, pharmaceuticals, etc. This should, by no means, signify that growth is not occurring in the older well-established products. Chlorine and caustic soda are typical of a number of "old" and basic industrial chemicals whose potential is directly tied to the long-term growth and development of industrial societies. As such, continuing growth may be expected from these heavy chemicals.

One way of measuring the future outlook for these items is to determine what their end uses are, or where they go when they leave the basic producer's plant. Once this is known, the outlook for these end uses is estimated; from this, the market estimates for relatively mature products such as caustic soda and chlorine can be made with a fair degree of accuracy. For example, if we find that in 1956 the pulp and paper industry consumed 527,000 tons of chlorine, then by estimating the growth of the pulp and paper industry we can determine its needs for chlorine in some future time. If we do this for all the chlorine consuming industries, then we have an estimate of the total chlorine consumption.

Chemicals such as chlorine and caustic soda are considered to be such fundamental building blocks for a technically developed society, that its projections are frequently used as basic indicators of the growth of the entire economy.

5 Trends in the Chlor-Alkali Industry

by Theodore Sheets, Jr.

In charting future consumption patterns of the chlor-alkali industry, one can assume that the economic health of the nation of the past several years will continue, that peace will prevail, and that sweeping new concepts of technology that might reorient chlorine's position in the chemical

Reprinted with permission from *Chemical Engineering Progress*, Vol. 53, No. 10 (October, 1957), pp. 482–488. Mr. Sheets handles sales and market planning for the Diamond Alkali Company.

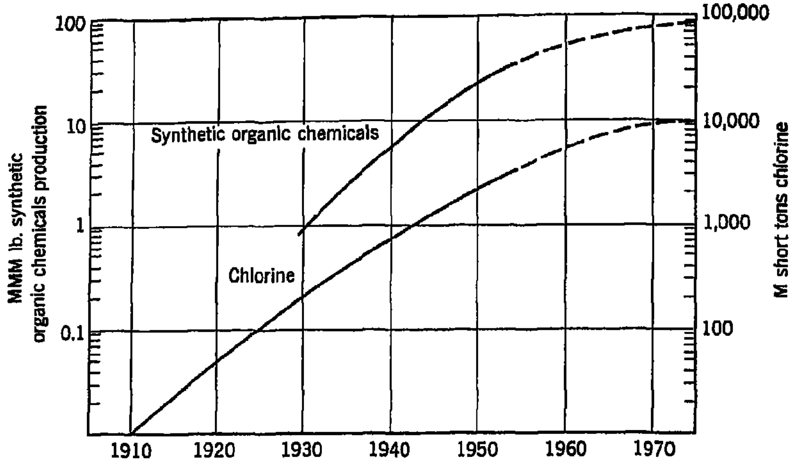


Figure 1. Comparison of chlorine production with synthetic organic chemicals. (Ref. U. S. Tariff Commission, Dept. of Commerce.)

industry shall not arise. If these generalities can be made, broad trend patterns in chlor-alkali use may be offered.

Use of chlorine in synthetic organic chemical manufacture has absorbed increasing tonnages and percentages of total chlorine production annually. This trend is expected to continue. Figure 1 depicts the growth rate of synthetic organic chemicals with indications of leveling somewhat during the next twenty years in contrast to the 1935 to 1955 era. If a curve is drawn for chlorine production similar to that for synthetic organic chemicals, about 7.4 million tons of chlorine may be expected in 1965 and about 11 million in 1975. With 81% of chlorine production (1955) and an estimated 88% in 1975 entering chemical manufacturing, such an approach may give a more realistic estimate for chlorine growth than would variable increments or a Gompertz curve with its forecast of about 19 million tons for 1975.

In Figure 2 the relationship between 0.33 million tons chlorine produced in 1935 is compared with the forecast 11 million tons for 1975. The area of a circle drawn for the production of 1925 would be about 1/3 that for 1935. In a study of the end-uses for chlorine and caustic soda, shifts will be traced in consumption from 1935 through 1955 with projected trends to 1975.

For convenience, five classifications are reviewed in Figure 3: chemicals and related products, such as metals, pulp and paper, sanitation, cotton textiles, and net exports. The greatest growth is expected in chemical usage.

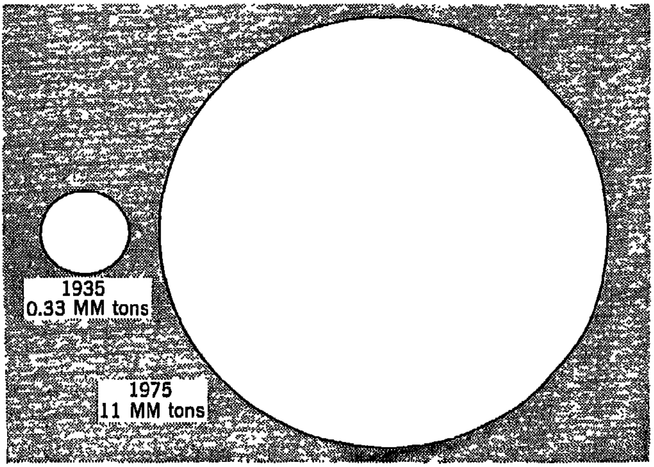


Figure 2. Comparison of production of chlorine in 1935 and estimate for 1975.

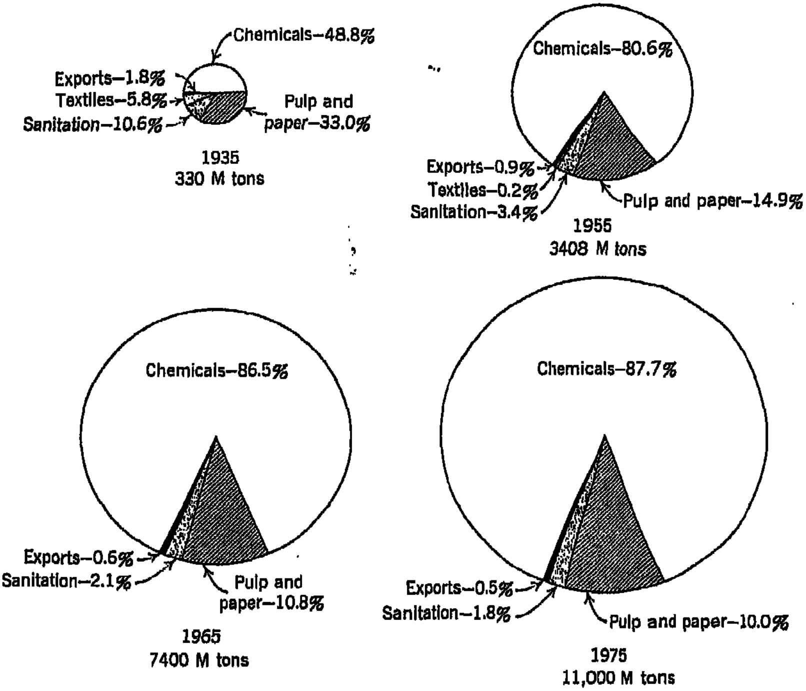


Figure 3. Trends in chlorine end-uses, 1935-1975.

Table 1—Trends in Chlorine Use—1935–1975 (M short tons)

	Chemicals		*Pulp & Paper*		*Sanitation*		*Cotton Textiles*		*Net Exports* +		*Total Production*
		%		%		%		%		%	
1935	161	48.8	109	33.0	35	10.6	19	5.8	6	1.8	330
1955	2,745.5	80.6	510	14.9	117	3.4	5.5	0.2	30	0.9	3,408
1956	3,113	82.3	527	13.9	122	3.2	4	0.1	19	0.5	3,785
1965	6,400	86.5	800	10.8	155	2.1	(7)*	(<0.1)*	45	0.6	7,400
1975	9,640	87.7	1,100	10.0	200	1.8	(10)*	(<0.1)*	60	0.5	11,000

+ Net exports = exports minus imports.

* *Absorbed in chemicals.*

Use of chlorine in chemical manufacturing will tend to grow more slowly after 1965 when functioning more closely with synthetic organic chemical needs is anticipated. In view of expansions in the pulp and paper industry, enlarging use of chlorine for bleaching appears assured. To service an increasing population with its rising per capita consumption of water coupled with larger waste disposal facilities, additional chlorine will be needed for sanitation in safeguarding the nation's health. These data are presented in tabular form in Table 1.

On a percentage basis, pulp and paper as well as sanitation will decline somewhat, although tonnages of chlorine entering these outlets will continue to increase.

In the future, usage of chlorine for bleaching cotton is expected to become modest.

Increased production from foreign chlor-alkali plants will tend to offset any possible significant gains in the export market.

In 1935 the per capita consumption of chlorine in the U. S. was about 3.5 lb.; in 1955 this value came near 41.0 lb.; by 1965, this estimate should approach 77 lb.; by 1975, 100 lb.

Table 2 reviews tonnages of chlorine used in 1956 for the manufacture of certain chemicals.

Table 2. Estimated Use of Chlorine in the Manufacture of Certain Chemicals and Related Products (1956)

	M Short Tons Chlorine Used
Solvents	
Trichloroethylene	190
Perchloroethylene	160
Carbon tetrachloride	240
Intermediates	
Ethylene oxide	330
Monochlorobenzene	160
Ethylene dichloride	200
Insecticides	
DDT (partial duplication of MCB)	92
BHC	34
Pentachlorophenol	6
Inorganic	
HCl (synthetic)	176
Titanium (metal)	56
Aluminum chloride (anhydrous only)	29
Others	
Glycerin	138
Vinyl chloride	200

Table 3 presents similar data for 1955. The increase in production of many of these chemicals from 1945 vs. 1955 is indicated.

Table 3. Estimated Use of Chlorine in the Manufacture of Certain Chemicals and Related Products (1955)

% Increase of Production 1945–1955	*Chemical*	*M Tons Chlorine Used*
	Solvents	*Total 647*
170	Trichloroethylene	175
300	Perchloroethylene	154
140	Carbon tetrachloride	227
425	Chloroform	31
120	Methyl chloride	27
680	Methylene chloride	33
	Intermediates	
450	Ethylene oxide	310
185	Monochlorobenzene	157
220	Ethyl chloride	165
340	Ethylene dichloride	196
	Monochloroacetic acid	20
	Chlorinated aromatics	
	Trichlorophenol	2
	Trichlorobenzene	8
	Benzyl chloride	4
	Insecticides	
	Benzene hexachloride	24
220	o-Dichlorobenzene	11
210	p-Dichlorobenzene	23
380	DDT	83
	2,4,5-T	1
	2,4-D	20
	Pentachlorophenol	5
	Inorganic	
200	HCl (synthetic)	150
	Titanium metal	30
172	Aluminum chloride (anhydrous only)	29
	Bromine and compounds	42
	Resins	
	Vinyl chloride	175
	Chlorinated paraffin	17
	Others	
	Glycerin (synthetic)	128

Chlorinated Solvents

The striking growth rate in chlorinated solvents is expected to moderate in the future. Use of trichloroethylene will probably follow demands in metal finishing for vapor degreasing. Perchloroethylene has eclipsed carbon tetrachloride as a dry-cleaning solvent owing to its less toxic properties, with expansion expected as naphtha-plant owners in the industry continue their switch to synthetic systems. Additional tonnages are expected to enter metal-degreasing applications. The future of carbon tetrachloride seems linked with increasing production of fluorinated hydrocarbons. Confidence in the refrigerants and propellant market is expressed by the erection of new facilities by the chemical industry. Further encroachment by other chlorinated solvents such as chloroform and methylene chloride, and by petroleum gases such as butane, is expected. The demand for methyl chloride for manufacturing butyl rubber and silicone resins and for methylene chloride-based paint removers has sparked a swelling consumption for these chlorinated methanes. The rise in production of these solvents from 73 million in 1935, 483 million in 1945 to 906 million pounds in 1955 requiring 647 thousand tons chlorine, 19% of total 1955 chlorine production, emphasizes the importance of the solvent outlet.

Since the advent of the first direct oxidation ethylene oxide plant in 1937, there has been a shift industrywise toward this route. Direct oxidation accounts for about 52%, chlorohydrin 48% of today's estimated 1.18 billion pounds ethylene oxide capacity. Although current expansions continue to favor direct oxidation, the chlorohydrin route still has its adherents as exemplified by an additional 60-million pound facility soon to be erected. The gains in sales for ethylene glycol plus rising demand for surfactants, acrylonitrile, and ethanolamines, will continue to be an important chlorine consumer but will decline percentagewise of total ethylene oxide produced.

If the advent of gas turbine or free-piston-powered cars and trucks materializes in volume as expected, sometime during the next two decades, consumption of automotive fluids as a consumer of chlorine will be significantly altered. For 1965, present estimates of about 950 million pounds ethylene oxide will be employed for the manufacture of ethylene glycol, 70% of which may be sold for antifreeze. For the same year 530 million pounds ethyl chloride (equivalent to 166 thousand tons chlorine) to manufacture an estimated 600 million pounds tetraethyl lead plus another 100 thousand tons chloride as ethylene dichloride may be used in compounding ethyl fluid.

Substantial quantities of ethylene dichloride, as an intermediate are used in vinyl chloride monomer production. The hydrochlorination of acetylene is an alternate route. Production in 1956 of vinyl and copolymers resins, the No. 1 plastic, was almost 650% more than production in 1945. On a vinyl chloride monomer basis, 1956 production was about 600 million pounds. Further enlarging consumption of this important chlorine outlet may be expected in the construction industry, in floor tile, coating textile goods, and in electrical insulation.

Chlorine

Although only 2,000 tons chlorine were used for phosgenation of amines in 1956, inplace capacity once utilized fully should employ 32 *thousand tons chlorine, more when future markets planned for* urethane foams near fruition. Vinylidene chloride, that portion of phenolics using the monochlorobenzene route, neoprene, and chlorinated rubbers, are other resin outlets. Smaller volume resins with varying growth potentials include Kel F, chloroacrylates, and chlorinated polystyrenes. Demand for chlorinated wax has declined since its World War II flameproofing experiences but a modest increased employment is expected in the future. Expansion of nylon 66 facilities by nine million pounds in 1956 and a further 55-million pound addition earmarked by 1958, plus other possible new intermediate salt production, will command greater tonnages of chlorine or high purity hydrogen chloride where such routes as the chlorination of butadiene or tetrahydrofuran to dichlorobutane are elected.

Insecticides

Almost twice as much monochlorbenzene was manufactured in 1955 vs. 1945, heralded by increasing consumption in such insecticides as DDT, the dichlorobenzenes, and larger demands from part of phenol and aniline manufacture. Further needs of MCB will probably follow expansion of these market patterns.

Propylene oxide, made by the chlorohydrin and oxidation routes, is expected to recapture loss in antifreeze use by rising demands for esters, resins, and hydraulic fluids by 1960.

Chlorinated xylenes offer promise as an intermediate for polyesters.

The future of benzenehexachloride appears linked with more effective methods of application and use since boll weevils have developed resistance to benzenehexachloride in certain areas. Lindane has been a trade disappointment. Pentachlorophenol in service for wood preservation is becoming more popular.

Other chlorinated pesticides include toxaphene, chlordane, methoxychlor, dieldrin, aldrin, heptachlor, TDE, 2,4-D, and 2,4,5-T.

DDT continues to lead in the production of insecticides with greater use being directed against corn borers and for aerial treatment of tracts of woodlands. About half U. S. production in 1955 entered world markets.

Increased quantitites of chlorine are expected in the future for the manufacture of chlorinated nematocides, such as DD, terrachlor, chloropicrin, and others, and miticides such as ovex, sulfenone, chlorobenzilate, when these preparations are more fully merchandised. Other promising pesticides combine chlorine and phosphorus, such as DDVP, ET 14 and 15, and chlorthion.

Increasing production of titanium sponge and, concurrently, its use of chlorine in the preparation of tetrachloride are expected to soften somewhat in the immediate future, while civilian markets, encouraged by easier methods of fabrication and new alloys, are exploited more fully.

As 95% of titanium has been used for military aircraft, adjustments in defense needs are felt very quickly. A portion of the nation's titanium oxide pigment production is made via the chlorine route.

Committed production for the A.E.C. for the next five years of eleven million pounds zirconium will absorb a probable 11,400 tons chlorine. A portion of the chlorine used for titanium and zirconium tetrachloride production is recovered by electrolysis, then recirculated. Continuation of titanium's phenomenal rise in consumption is contingent upon accelerating defense purchases. High purity silicon is made from the tetrahalide also.

Synthetic hydrogen chloride production has doubled between 1945 and 1955 primarily for high purity requirements, registering a slight gain, percentagewise, of total hydrogen chloride made by all methods.

Synthetic Glycerin

Production of synthetic glycerin has been rapidly overtaking the natural product and with a further increase of 35 million pounds by the allyl chloride method next year, about 47.5 thousand tons additional chlorine should be used. The alternate hydrogen peroxide-acrolein route may abridge further linear needs for chlorine in glycerin in the years ahead.

Chlorine is being used in larger volume to volatilize impurities in aluminum and in ferroalloys. Sodium hypochlorite is expected to continue its popularity as a household germicide. Other chemicals requiring chlorine include monochloroacetic acid, ferric chloride, chlorinated toluols, and phosphorus trichloride.

Further growth of chlorine in chemical manufacturing is based upon the expansion of most current end-uses, plus the exploitation of new products now venturing upon the scene and others expected within the next twenty years. Anticipated adjustments in markets for organic chemicals will be sensitively reflected by appropriate revisions in future chlorine production.

About 22% of the 1935 five million tons of pulp production was bleached sulfite and bleached and semibleached kraft. This expanding outlet for chlorine is emphasized by production of 5.5 million tons or 26.7% of these pulps of the 20.7 million tons total pulp production in 1955. This trend toward the manufacturing of more bleached pulp is expected to continue with a forecasted 29.6% in 1960 of 29.3 million tons pulp capacity being from bleached or semibleached sulfite, sulfate, and semichemical pulps.

Imports of pulp from abroad have held across the last twenty years between 1 and 2½ million tons, which assures larger markets for domestic chemicals production.

Estimates for 1965 of wood pulp production of 32 million tons is expected to use 800 thousand tons chlorine, and by 1975, 39 million tons pulp, 1.1 million tons chlorine.

Since chlorine dioxide has a lower oxidation potential than hypochlorite with resulting less degradation of fibers, it is expected to become more popular, particularly in the finishing stage of multibleaching sequences.

Sanitation

Sanitation has been a steadily growing user of chlorine. Percentagewise this outlet is not so important to total chlorine usage as it was twenty years ago, but its function in safeguarding the nation's welfare ranks this service above any dollar considerations. It is expected that at least 155 thousand tons will be needed for sanitation in 1965, 200 thousand tons by 1975. Perhaps 65% of this amount will enter municipal and industrial water plants with modest quantities for swimming pools. The balance will be purchased for sewage disposal and industrial wastes treatment. Challenges from ozone, ultraviolet lights, and bromination for treating water is not expected in this country.

Bleaching cotton goods with chlorine has been primarily supplanted with peroxides.

Exports are not expected to become a significant factor in the end-use pattern.

Other methods for producing chlorine which do not yield by-product caustic soda tender annual statistics much different ratios from an anticipated stoichiometric 1.13 tons caustic soda/ton chlorine. Production of metallic sodium primarily for TEL, for reduction of titanium tetrachloride, metal descaling, and miscellaneous uses produced 5½% of 1956's chlorine production. Other coproducts of chlorine are potassium hydroxide and lithium. Synthetic sodium nitrate is made by the nitrosyl chloride method. Broader experience with reactive sodium amalgam for compounds other than caustic appears certain.

Caustic Soda

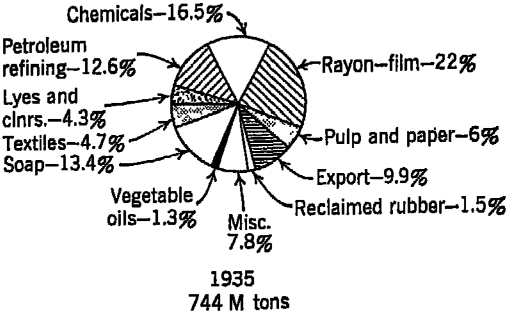
Table 4 estimates the production of 7.6 million tons caustic soda is probable in 1965 and 11.2 million in 1975. Market pressure is expected to reduce production of lime soda caustic soda to 100 thousand tons in 1965, and possible elimination altogether sometime afterwards.

Table 4 Comparison of Chlorine Production with Caustic Soda (M short tons)

	1935	1955	1965	1975
Production of chlorine	330	3,408	7,400	11,000
Production of caustic soda				
Electrolytic	316	3,439	7,500	11,200
Lime soda	428	466	100	0
Caustic soda—total	744	3,905	7,600	11,200

Figure 4 cites trends in caustic soda. Unlike chlorine consumption, which is sometimes used as a gauge for a nation's standard of living, caustic soda is a necessity among backward peoples as well as among the progressive ones. This versatile alkali is used in varying quantities by almost every facet of the industrialized economy.

Preference by industry for the more easily handled liquid forms is seen by 75.4% of total caustic soda production in 1945 increasing to an estimated 87% put to use in 1955 as liquor. During this decade production of anhydrous material statically fluctuated between 450 and 650 thousand tons.



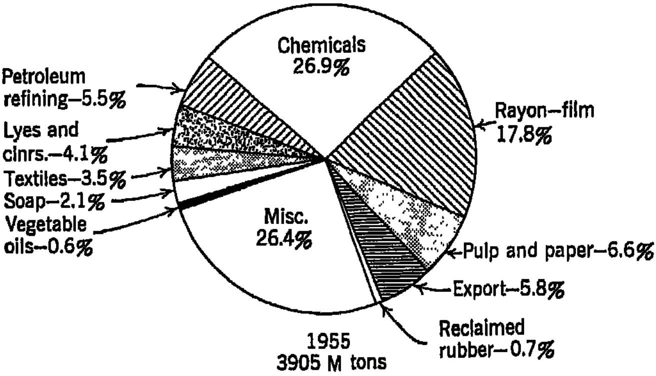
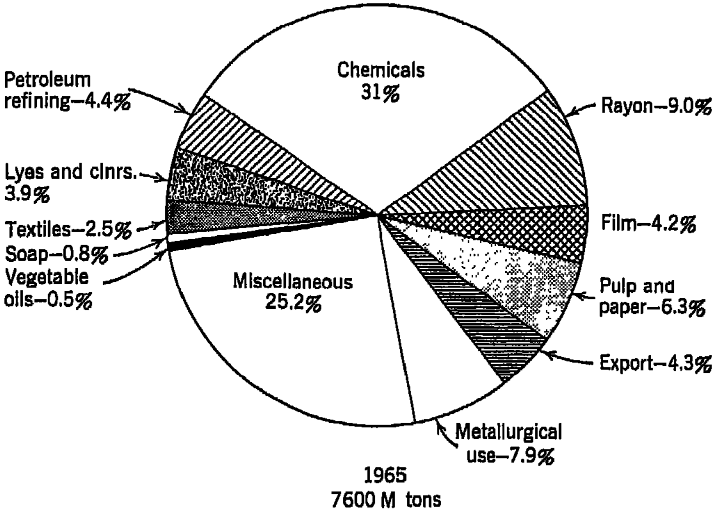


Figure 4. Trends in caustic soda consumption, 1935-1975.

Examination of per capita consumption of caustic soda and soda ash shows an increasing preference for caustic soda. During 1930-1935 a mean of 1 lb. caustic soda was employed for each 3.6 lb. ash; 1940-1945, 1 lb. caustic soda for every 2.8 lb. ash; 1950-1955, 1 lb. caustic soda for every 1.6 lb. ash (all years inclusive).

Outlets showing wider application, apart from linear requirements following general economic growth and a rapidly increasing population, include chemicals, pulp and paper, cellophane, and further new metallurgical examples.

A listing of certain chemical end-uses is given in Table 5. The utilization of caustic soda by the chemical industry has expanded almost a hundred times between 1935 and 1955. By 1965, 31% of caustic soda production and in 1975, 36% may be used for chemical manufacturing. Substantial quantities of alkali as in phenol production are used captively by the industry.



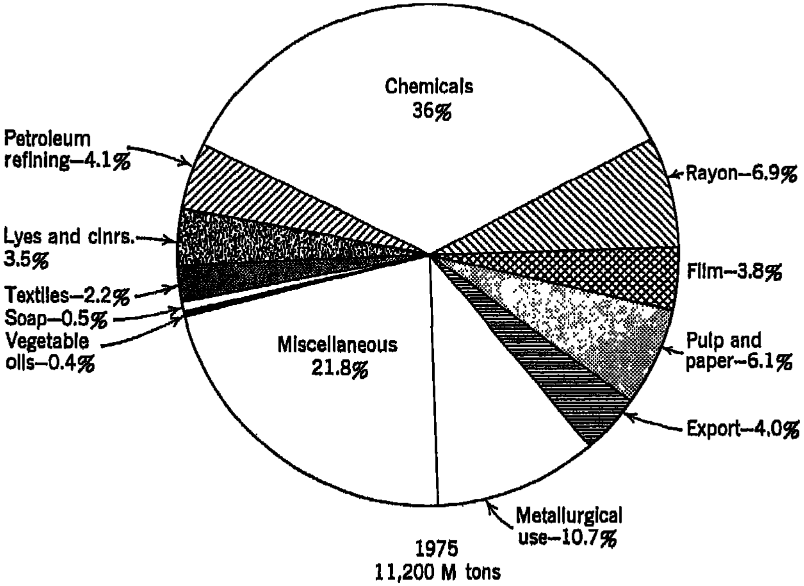


Figure 4. *(continued)*

Table 5 Certain Chemical Uses for Caustic Soda (M short tons)

Chemical	1956
Glycerin	62
Pentaerythritol	16+
Cresylic acid and cresols	15
Ethylene glycol	10
Formic acid	7
Trisodium phosphate	6
Toluol (coal tar)	5
2,4-D	7

+ = Basis: 100% usage of caustic soda.

In 1955, about 10 thousand tons caustic soda was used in synthetic ethanol production. Were all the chlorination and sulfonation capacity utilized that year in phenol production, 284 thousand tons caustic soda would have been required.

A delineation of caustic soda markets appears in Table 6. Although the production of 973 million pounds viscose rayon in 1955, almost 170% over 1945, and 470% over 1935 was at an all-time high, indications of maturity have appeared. This trend may be neutralized by such recent developments as the production of staple with enhanced strength and other improved physical properties signaling possibilities, through research and vigorous merchandising, for further growth of all types viscose rayon in 1975 to perhaps 1.4 billion pounds. Four and one-half times caustic soda was used for rayon and film production in 1955 vs. 1935 in face of improved chemical-recovery systems.

Cellophane production continues to mount in face of vigorous competition of polyethylene, styrene, and foils, and is expected to remain dominant in packaging with the estimated production of 325 million pounds in 1955, five times that of 1935. Additional capacity such as the 50-million pound plant in Tecumseh, Kansas, augurs further expansion for the probable 600 million pounds in 1965 and 780 million in 1975 during both decades about 4% of caustic-soda production entering this outlet.

Growth of caustic soda consumption in pulp and paper is expected to expand not only with increases in industrial capacity but by new uses as exemplified by the alkaline-mechanical pulping of hardwoods, particularly for groundwood. This added market, if it comes near fruition, should demand 60 thousand tons caustic soda of the estimated usage of 1965 of 480 thousand tons in the production of wood pulp, paper, and paper-

Table 6 *Trends in Caustic Soda—End-Use (M short tons)*

	1935		*1955*		*1965*		*1975*	
Chemicals	118	16.5%	1,050	26.9%	2,350	31.0%	4,000	36.0%
Rayon	158	22.0	695	17.8	680	9.0	780	6.9
Film					320	4.2	420	3.8
Pulp and paper	43	6.0	258	6.6	480	6.3	680	6.1
Export	71	9.9	227	5.8	330	4.3	450	4.0
Petroleum refining	90	12.6	215	5.5	335	4.4	460	4.1
Lyes and cleaners	31	4.3	160	4.1	295	3.9	390	3.5
Cotton textiles	34	4.7	137	3.5	190	2.5	250	2.2
Soap	96	13.4	82	2.1	60	0.8	55	0.5
Reclaimed rubber	11	1.5	27	0.7	10	0.1	. .	. . .
Vegetable oils	9	1.3	24	0.6	35	0.5	45	0.4
All others (including metallurgical uses)	55	7.8	1,030	26.4	2,515	33.0	3,670	32.5
Metallurgical uses					(600)	(7.9)	(1,200)	(10.7)
Total production	716	. . .	3,905	. . .	7,600		11,200	

board. In 1975, this added market could reach 80 thousand tons of a total of the year's 680 thousand tons.

Substantial quantities of chlorine and caustic soda needs will continue to be supplied by inplace captive chlor-alkali capacity in pulp mills.

Greater consumption of caustic soda in future world markets will be met to a larger extent by enlarging foreign capacity with accompanying greater competitive pressure in the market.

Caustic soda usage by the petroleum industry in 1955 was 2½ times that of 1935. Broadened internal usage in refineries is not probable with modest encroachment by caustic potash expected for sulfur removal. The expected growth in multiple ownership of automobiles, plus rising population requiring more fuel, may heighten demand of caustic soda to 460 thousand tons or more by 1975, this statistic on the assumption that gasoline consumption patterns continue present growth rate.

Lyes and cleaners have maintained a level of caustic soda usage slightly above 4% from 1935 to 1955. Consumption patterns are expected to follow general levels of industrial activity. About 3½% of caustic soda production may enter this market in 1975.

Use of caustic soda for kier boiling and mercerizing for cottons is expected to continue and probably linearly with total broad woven goods production expected to approach 7 billion pounds in 1975. At that time natural fibers may be overshadowed by preponderant usage of synthetics.

The perennial decline in soap production currently shows tendencies to moderate for the future. Although 1935's caustic soda market was 13.4% for soap, 1955 saw this drop to 2% and may decrease to 0.5% in 1975. This shift towards detergents is not a total market loss for caustic soda inasmuch as caustic is used in the synthesis of many syndets, as in the neutralization of excess sulfuric acid for dodecyl benzene sulfonate manufacture.

Use of caustic soda in defiberizing rubber has declined with a shift toward neutral baths for $CaCl_2$ and $ZnCl_2$ or by mechanical milling since the advent of synthetic rubber and mixtures of synthetics with natural.

Although vegetable oils have been beset with government quotas, declining margins, and other uncertainties, worldwide shortages and U.S. needs should broaden this tonnage usage of caustic soda for the future.

Within the "all others" classification has been included a review for metallurgical uses which has promise of fast becoming a major market for caustic soda. It has long been a well-known fact that alkalis such as soda ash and caustic soda used alone or modified with other materials are excellent agents to control minor but important constituents in steel such as sulfur and silicon. Engineers have only recently been successful in designing equipment to perform this perplexing task. High sulfur content coke should, therefore, be of less concern to quality-conscious blast-furnace operators and ferrous foundrymen. Other growth metallurgical outlets include alumina extraction and digestion of thorium, zirconium, and other metal-bearing sands.

Caustic soda is used to precipitate uranium in alkaline leaching of its ores.

The lye peeling of vegetables and fruits is a minor caustic soda use showing promise of modest expansions using an estimated nine thousand tons in 1955.

Where chlor-alkali producers are faced with regional surpluses of caustic soda, increased tonnages can be carbonated to service the needs of ash users.

Table 7 displays the end-use pattern for 1956. Chlorine's promise for the future lies with expanding technological advances for larger chemical applications. Appropriately, larger percentages of chlorine are expected to be used captively by chlor-alkali producers.

Table 7 Caustic Soda End-Use (1956 estimate)

	End-Use	*Tons/Day*	*M Tons/Yr.*	*Approximate % of Total*
1.	Chemicals	3,070	1,120	26.6
2.	Rayon	1,310	478	11.3
3.	Film	643	176	4.2
4.	Pulp and paper	844	307	7.3
5.	Net export (exports-imports)	703	257	6.1
6.	Petroleum refining	624	228	5.4
7.	Lyes and cleaners	470	172	4.1
8.	Textiles	370	135	3.2
9.	Soap	210	77	1.8
10.	Vegetable oils	80	29	.7
11.	Reclaimed rubber	36	13	.3
12.	All others	3,340	1,220	29.0
	Total	11,700	4,212	100.0

Caustic soda will base its growth upon familiar end-uses in well-delineated fields with swelling advances in industrial chemicals, pulp and paper, and new markets in metallurgy.

To avoid possible imbalances between caustic soda and chlorine, further new uses for both products must be developed.

Alert alkali producers, well aware of this broad trend, have pushed expansions so that adequate chlorine supplies appear assured for the next several years. During the first four months of this year there was an average daily production of 10,670 tons chlorine. By the end of next year the industry may have available an estimated additional 1,700-tons/-day capacity. Among the more important projected ones are Diamond—planned 200 tons/day additional chlorine; Dow—400 tons; Wyandotte 300 tons; Jefferson—150 tons; Olin Mathieson—125 tons; Kaiser—100 tons; Solvay 100 tons; Weyerhauser 100 tons.

Through advances in technology, cell rooms are able now to deliver higher tonnages of product than those for which they were originally designed. Increased chlorine production streams from two sources: (1) expansion of plant facilities, and (2) upping present production from inplace capacity by use of larger cells, higher amperages, and improved materials of fabrication.

Owing to the high cost of new chlorine facilities, there has been a general shift away from the erection of further new captive plants. Such capital is being advantageously used to enlarge primary product lines which ordinarily earn higher rates of return. This mounting cost has arisen not only because of a universally felt inflation, but is due, perhaps, in an even larger measure to embellishments resulting from the physical nature of this business. Increased emphasis is directed toward plant and community safety. Caution is exercised to avoid escape of even small amounts of chlorine in the air with its accompanying odor and fume problems. Discharge of effluent is discouraged so improved waste disposal systems must be installed. Employee comforts are stressed. Vigilant cleanliness in mercury-cell rooms reduces health problems to a minimum. Objectionable dust and fumes in caustic soda processing are exhausted. Although these costs disarmingly appear incidental, their summation is one of magnitude.

Chlorine, a charter member of the heavy chemical family with its classically established production methods and a finite technology, offers monetary satisfaction only to those firms satisfied with profit margins lower than those popularly associated with the chemical process industries. It is significant, perhaps, to note that chemical firms showing the highest rates of return on investment are not in the merchant chlorine business.

Acknowledgment

Thanks are herewith expressed to colleagues in Diamond Alkali Company, Frank Chrencik, Electro Chemicals Division, general manager, and C. C. Silsby, Jr., Electro Chemicals Division, manager of research and development, for their kindnesses in reviewing this article and for their helpful suggestions. The cooperation of Chlorinated Products Division, Loren Scoville, general manager; Bruce Gleissner, assistant general manager; and D. J. Porter, division technical manager, is similarly appreciated.

In contrast to the relatively staid chlor-alkali industry, the thermoplastics industry is one of the dynamic, glamorous and volatile CPI branches. It is characterized by price cutting, temporary periods of overcapacity, rapid growth in volume, patent clashes between producers, invasion by new firms from other CPI branches and firms new to the CPI, etc. Since it is not yet a mature industry, new breakthroughs in both technology and marketing frequently occur within it.

This market study takes a relatively broad view of the industry, surveying the outlook for a variety of thermoplastic materials. The survey differs from the chlor-alkali report in that it places more emphasis upon the future than upon the past. This is necessary, for in an immature industry the past is seldom a suitable yardstick with which to estimate future performance. It can be seen, however, that even a growth industry such as this can have mature segments, e.g., cellulosics are expected to remain constant in volume. This is in sharp contrast to polycarbonates, which are expected to grow in volume from 1 million pounds in 1960 to 25 million pounds in 1965.

6 Thermoplastics: Progress Amid Problems

by Walter S. Fedor

Next week, the Society of the Plastics Industry will put on its most mammoth effort—the 9th National Plastics Exposition in New York's Coliseum. The functional and decorative aspects of plastics and resins will be quite evident. Some 53 resin producers, plus about 200 fabricators, processors, and others, will see to that. Their exhibits will dramatize the progress but are not apt to display the problems of the U.S. plastics industry.

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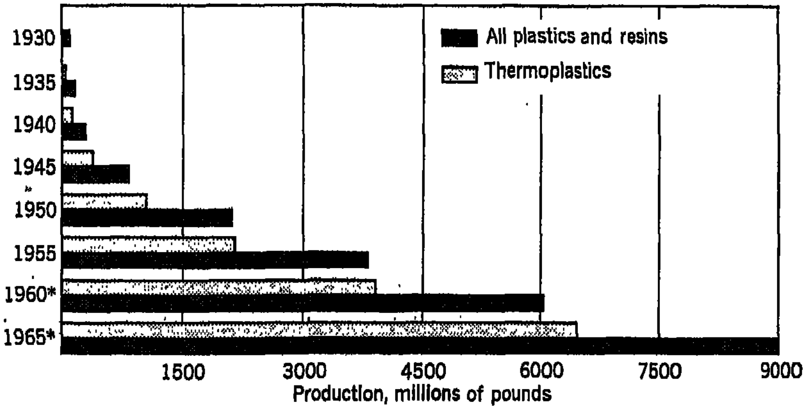
Make no mistake, the plastics industry today is no picnic. The big three materials of the business—polyethylenes, vinyls, and styrenes—are saddled with below-list selling prices and resulting profit problems, as are some other thermoplastics. Excess capacity is seemingly everywhere. Yet the rush to build new plants continues, even though the prospects for profitable operating rates in a few years are apparently remote. Most of the problems fall on thermoplastics—the most dynamic segment of the plastics industry.

Since 1955, thermoplastic resins have grown about 100%, while thermosetting materials have advanced 25%. This has come about as polyethylene has opened huge markets, particularly in film, and as vinyl and styrene resins have defied all predictions to level off and have continued to forge ahead with great gusto.

And the thermoplastic growth shows no signs of letup over the next few years. Introduction of polyethylene, acetal resins, and various copolymers promises to push thermoplastics production to the 6.4 billion-pound level by 1965. Then production of all plastics and resins should approach 9 billion pounds, consumption around 8 billion pounds.

The progress through 1965 will be highlighted by intense competition within the plastics field. Far too often, plastics are introduced and aimed at markets already opened by other plastics. The days of the "automatic" market are nearing an end. Much reliance must now be placed on well planned and well executed development programs to find really new markets.



Output of plastics and resins is headed for 9-billion-pound mark in 1965. (Sources: Stanford Research Institute and *C&EN Estimates.)

Many of these new markets will lie in areas where plastics are already being used. The market for thermoplastics in packaging is around 500 million pounds now and could double by 1965. Automobile uses for thermoplastics could jump from about 22 pounds per auto now (on the average) to around 45 pounds by 1965, or a total market for about 300 million pounds. The construction industry offers vast potentials in roofing, panels, and insulation. In 1960, about 900 million pounds of plastics were used in construction, 600 million of which was thermoplastics. These and other end-use areas will move the entire thermoplastics field ahead. Only rarely does anyone today predict a decrease in usage through 1965.

Polyethylene at the Top

Polyethylene reigns as king of the plastics industry. Production this year should reach 1.45 billion pounds, some 9% better than last year's. About 300 million pounds of this output should be linear polyethylene.

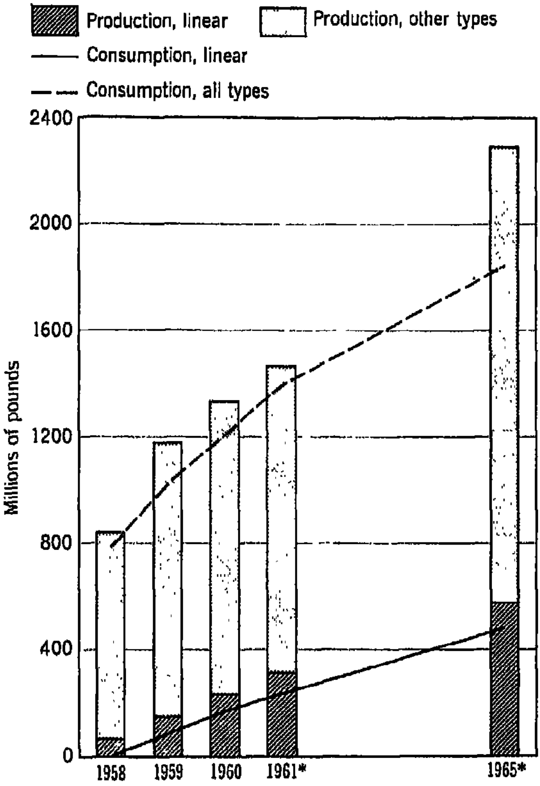
Consumption of all types of polyethylene should pass 1.3 billion pounds, about 11% more than last year's. Linear consumption could hit 260 million pounds.

Never in the plastics history has a product group grown so fast. Since 1950, polyethylene's growth rate has averaged 25% a year. In 1948, sales were 17 million pounds; 11 years later, they passed the billion-pound mark. Polyethylene's growth rate has started to slow down and will probably average 15 to 17% a year over the next five years.

Production in 1965 should run about 2.3 billion pounds, consumption near 1.9 billion. Linear's part will be 550 million pounds produced and 470 million consumed.

Such growth forecasts are impressive. So, too, is the staggering excess capacity. Total capacity is roughly 1.8 billion pounds now and by 1962 is slated to hit a whopping 2.6 billion pounds—1.95 billion for conventional polyethylene and 658 million for linear.

Surplus capacity contributes to price and profit weaknesses in the polyethylene business. Conventional material is down to 27.5 cents a pound (general purpose and film grade). Some firms are selling a molding grade for 26 cents. However, the trade reports prices as low as 17 cents, although more commonly 22 to 25 cents a pound. Admittedly, some of these low prices apply to off-grade resins. And, the price weakness is mostly in molding resins; the price of film grade material is apparently firm.



Polyethylene production and consumption.

Linear's price is also in flux. Molding grade lists for 35 cents a pound, and extrusion grade for 38 cents. Prices between 26 and 33 cents are mentioned by the trade—again at times for off-grade material.

There is little hope that polyethylene's price will rise in the foreseeable future. Union Carbide's refusal to go along with Du Pont's proposed 2.5 cent-a-pound hike for conventional polyethylene this year apparently doomed any hopes for higher prices for a while. One segment of the industry says higher prices are needed to pour money back into development efforts for new resins. The other emphasizes that lower prices will create wider markets. There is some truth to both sides.

Obviously, the polyethylene business today is quite complex and getting more so. One company explains that it has about 150 different types of homopolymers, copolymers, mixed polymers, or chemically modified polyethylenes. Most are designed for specific uses.

One segment rapidly gaining momentum now is copolymers. It affects the linear field mostly and is just getting started in the conventional market. Almost any hydrocarbon or functional group will react with ethylene to make a copolymer. Those made with butene-1 are currently the most popular. Other copolymers that are becoming available include acrylates and acetates.

Copolymers got rolling with the growing demand for blow molded detergent bottles. Since then, blow molding has been used in making bleach bottles, but these are made from homopolymers. Blow molding should consume 115 million pounds of polyethylene this year and grow to 230 million pounds in 1965. By then, 70% of the polyethylene consumed in this use should be linear material; it's nearer 75% now.

Coatings are another promising area, particularly extrusion coatings. Future demand here could double 1961's expected demand for 110 million pounds. Especially promising is the outlook for polyethylene in milk cartons, either alone or with wax.

Meanwhile, film and sheeting, which have long been polyethylene's major outlets, show no signs of letting up. Sheeting consists of material 10 mils thick and over and is about 7 to 9% of the film and sheeting market. Film and sheeting took 350 million pounds of polyethylene last year and could use 395 million pounds this year. This market is expected to reach 540 million pounds in 1965. Practically all of this film and sheeting will be made from conventional polyethylene. Linear material has little future as a film, although sheeting offers good possibilities, particularly in packaging frozen foods. Packaging currently takes about 75% of the polyethylene film produced, construction 12%, and agricultural uses about 4%.

In injection molding, the consumption of linear polyethylene may exceed that of conventional material by 1965. Typical uses are housewares and toys, probably the most competitive segment of the plastics industry. The end-use ratio this year should go 58% conventional, 42% linear. The ratio will probably run 48% conventional and 52% linear in 1965.

Still growing are extrusion uses, such as pipe and wire coatings. Growth should average about 12% a year through 1965.

Apparently, the only polyethylene decline will be in exports. A decrease might come this year, but some observers prefer to take a "wait and see" attitude. The European price drop to 25.6 cents a pound, plus the possibility of higher European tariffs, greatly concerns domestic producers today. Exports ran about 330 million pounds last year and should continue at about the same level this year. Exports are 25%

of the polyethylene business now. A decline to 190 million pounds is forecast for 1965. Imports should not affect the domestic market during the next few years.

Market for Polyethylene Continues to Grow, Aided by Rising Demand for Linear Material

	Consumption, Millions of Pounds					
	1960*		1961*		1965*	
	Conventional	Linear	Conventional	Linear	Conventional	Linear
Film and sheeting	342	8	375	20	510	30
Injection molding	85	70	110	80	135	145
Blow molding	15	45	30	85	70	160
Extrusions (wire coating, pipes, etc.)	133	23	150	40	210	75
Coatings, including extrusion coatings	90	2	105	5	200	20
Exports	310	20	300	20	180	10
Miscellaneous	47	6	50	10	90	30
Subtotals	1022	174	1120	260	1395	470
Grand totals	1196		1380		1865	

Sources: U.S. Tariff Commission and *C&EN Estimates

Polypropylene Production Is Starting to Climb, Should Reach 425 Million Pounds a Year in 1965

	Consumption, Millions of Pounds		
	1960	1961	1965
Injection molding	15	28	150
Blow molding	—	3	30
Extrusions	1	3	15
Films and sheet	2	7	75
Fibers: Monofilament	8	13	35
Multifilament	1	4	25
Export	3	9	20
Miscellaneous	3	6	20
Totals	33	73	370

Source: C&EN Estimates

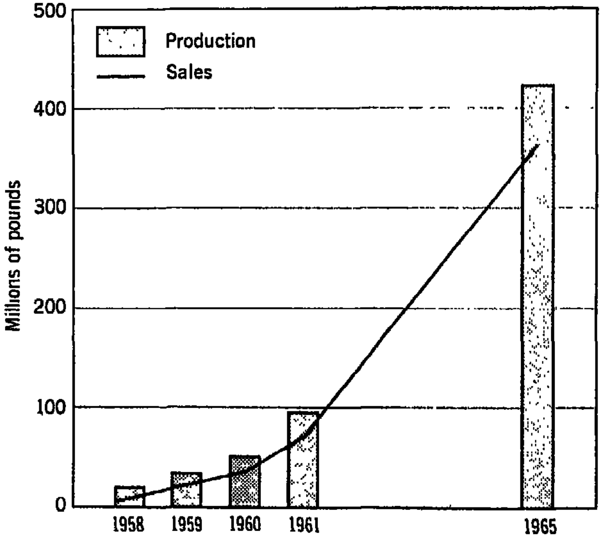
Polypropylene Picture

Polypropylene is off to a faster start than was its cousin, polyethylene, initially. Although this is no criterion for its future destiny, polypropylene could climb into the billion-pound class around 1968 if the pace continues. The big if: How well will it do as a textile fiber?

The major concern among domestic producers is the spiraling capacity. Hercules, AviSun, Humble Oil, and Tennessee Eastman produce the resin. Total capacity is 175 million pounds. Before this year ends, Dow, Novamont (Montecatini), and Firestone should start to produce, and capacity will rise to 375 million pounds. Shell will start up in 1962, and Rexall will probably be a producer in 1963. The planned capacity is thus 485 million pounds and far from complete. Phillips, Allied, Du Pont, Monsanto, and U.S. Industrial Chemicals are probable producers. The question: When?

Meanwhile, concern for the rapid capacity build-up is highlighted by marketing arrangements between Humble and Spencer, Carbide and Shell, and most recently by Grace and Novamont. The trend is to get into the market without tying up capital in plants. As the market develops, Spencer, Grace, and Carbide might build their own plants.

Polypropylene production was about 37 million pounds last year, consumption around 33 million. This year, output could reach 80 million



Polypropylene production and consumption.

pounds, with consumption near 73 million pounds. Outlook for 1965 is for production of 425 million pounds and consumption of 370 million.

Injection molding is the largest outlet for polypropylene now and will remain so through 1965. Many uses today consist of small items such as vacuum bottles and napkin holders. But larger moldings are coming. Luggage shells, TV cabinet backs, and tote boxes are examples. Important gains lie in moving polypropylene into engineering applications such as instrument clusters and automobile dashboards, where it could replace die cast metals. Injection moldings could consume 150 million pounds of polypropylene in 1965, compared to 28 million this year. Molding resins sell for 42 cents a pound now and could be down to 30 to 35 cents in 1965.

Blow molding is just getting started and should grow to 30 million pounds in 1965. However, polypropylene's future use in extrusions such as pipe and wire coatings is still uncertain.

Film uses are beginning to move now and have established some packaging applications—for example, as a bread wrap. Growth has not been as fast as hoped for, mainly because of wrapping equipment problems. About 75 million pounds of polypropylene should end up in film applications in 1965. When the polypropylene end-use pattern firms up some years from now, films should account for about 25% of the market.

But the largest end use for polypropylene should be fibers—about 40 to 45% of the consumption pattern. As a monofilament, it has made good progress in the rope and webbing field. Use here should triple by 1965. However, multifilament growth is another story. It takes time to get fibers moving—on the average, eight years to obtain a 50 million-pound volume. Also, polypropylene has melting and dyeing problems which are not insurmountable but need time to solve. Initial growth should come in carpets and apparel.

Little is said about tire cord possibilities. Hercules, Beaunit, AviSun, and Reeves have, or will shortly have, small plants to produce polypropylene multifilament fibers. Most of the output will be used for testing purposes. Novamont plans to build a 25 million pound-a-year polypropylene fiber plant at Neal, W. Va., which is due on stream in 1962 or 1963.

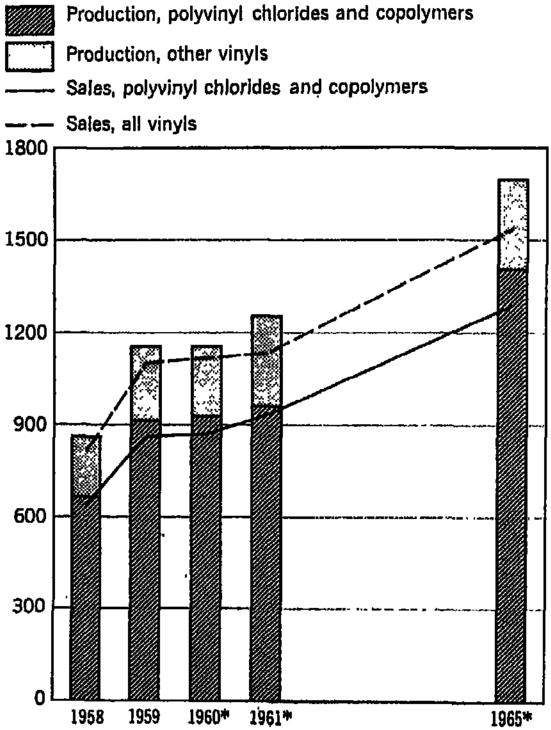
Vinyls

Vinyls are probably the most versatile resin class yet developed. Uses range from molded products, films, and sheets to rigid products and latex paints. Production of vinyl resins of all types was 1.17 billion pounds last year and should increase 5% in 1961. By 1965, almost 1.7 billion pounds is expected.

Consumption should make similar progress. About 1.1 billion pounds was consumed in 1960 and about 5% more is expected this year. The forecast for 1965 is 1.55 billion pounds.

Polyvinyl chloride and its copolymers are the most important vinyls. Most often, the copolymer contains polyvinyl acetate. Production should run 950 million pounds this year and increase to 1.4 billion in 1965, a growth averaging 10% a year. Despite this healthy growth outlook, PVC also has problems of excess capacity. Capacity was around 1.4 billion pounds last year and will hit 1.5 billion in 1962. There are 22 producers.

Excess capacity is blamed for weak prices in PVC. Two price drops last year brought the price down to 18.5 cents a pound from 23.5 cents. Trade reports point to PVC selling for 16.5 and 17 cents a pound—



Vinyl production and consumption.

another case of under-list selling. Vinyl chloride monomer prices have been weak also, but may be firming up around 9 cents a pound.

Further competitive problems in the vinyl field come from imports of finished products. Often cited as a problem are the imports of vinyl raincoats from Japan. These took 9.5% of the U.S. market in 1958 and rose to about 50% in 1959 and 1960. Imports of vinyl resins are small and probably ran around 8 million pounds in 1960. Last year, vinyl exports were about 90 million pounds and may be a bit higher this year.

Polyvinyl chloride's largest application is in molding and extrusion to produce phonograph records, garden hoses, and other products. Based on first quarter results, consumption will run a bit above 1960's. In the past, growth in this area has often depended upon finding a new application almost yearly, but nothing seems new this year. By 1965, this end-use segment should increase modestly to 350 million pounds. One factor could increase this forecast—a rapid surge in rigid vinyls. These account for about 25 million pounds a year now and could move fast if they gain wider acceptance in the construction industry. Some forecasts call for up to 100 million pounds to be consumed in 1965. One growth possibility is rigid pipe such as the polyvinyl dichloride developed by B. F. Goodrich Chemical.

Wire coating extrusions are a 100 million pound-a-year market now and are still growing. Slush and elastomeric moldings promise to move beyond the 60 million-pound level in 1961. Other items such as phonograph records and garden hoses should make modest gains.

Strong gains are expected for vinyl flooring, in part because of new construction, but mostly as a result of renovation projects. This end use should take about 180 million pounds of vinyl in 1961 and about 70% more in 1965.

Meanwhile, the market for film and sheeting is still expanding and could get a strong boost from the new PVC price. It may become more inviting, for example, as a packaging film. Extruded vinyl sheet for use in coating steel is developing slowly but may be moving well in 1965. Combined consumption of vinyl film and sheeting may reach 390 million pounds then.

Another interesting outlet is extruded vinyl foams. A 4 million-pound market last year, it could go to 10 million this year and at least to 25 million by 1965. Typical use is as foam liners in vinyl garments.

Significant to the over-all vinyl resin picture are miscellaneous resins such as polyvinyl acetate, polyvinyl alcohol, polyvinylidene chloride, and polyvinyl butyral. Polyvinyl acetate's major use is in making adhesives, water based paints, textile finishing products, and binder coatings for paper. Adhesives are the major use, accounting for about 45% of production. Paints consumed about 30%. Production was about 150 million pounds in 1960 and should increase around 9% a year through 1965. Sales are close behind.

Meanwhile, future price declines are expected in polyvinyl alcohol. The least expensive grade currently sells for 57 cents a pound but should be lower in 1965. The alcohol is used in many markets with adhesives being the most significant, taking about 12 million pounds a year and expected to grow at a rate near 7% annually. The textile industry uses about 5 million pounds a year for sizing and finishes. Other outlets include paper coatings, colloids, and films. Best prospect for future growth lies in soluble films and fibers. Air Reduction has a license from Kurashiki Rayon of Japan, has been studying applications for several years now.

Polyethylene Capacity 2.6 Billion Pounds, Polypropylene 485 Million by 1962

Capacity in 1961 or 1962, Millions of Pounds

Company and Location	Conventional Polyethylene	Linear Polyethylene	Polypropylene
Allied Chemical			
Orange, Tex.	—	40	—
Tonawanda, N.Y.	—	30	—
AviSun			
New Castle, Del.	—	—	100
Port Reading, N.J.	—	—	25
Celanese			
Pasadena, Tex.	—	50	—
Dow Chemical			
Bay City, Mich.	—	25	10
Freeport, Tex.	100	—	—
Plaquemine, La.	50	—	—
Torrance, Calif.	—	—	30
Du Pont			
Orange, Tex.	280	60	—
Victoria, Tex.	60	—	—
Firestone			
Hopewell, Va.	—	—	10
Foster Grant			
Beaumont, Tex.	10	—	—
Goodrich-Gulf			
Port Neches, Tex.	—	13	—

Polyethylene Capacity 2.6 Billion Pounds, Polypropylene 485 Million by 1962 (cont.)

Company and Location	*Conventional Polyethylene*	*Linear Polyethylene*	*Polypropylene*
W. R. Grace			
Baton Rouge, La.	—	75	—
Hercules			
Lake Charles, La.	—	30	90
Parlin, N.J.*	—	80	30
Humble Oil & Refining			
Baytown, Tex.	—	—	40
Koppers			
Port Arthur, Tex.	60	—	—
Port Reading, N.J.	—	20	—
Monsanto			
Texas City, Tex.	130	—	—
Novamont (Montecatini)			
Neal, W.Va.	—	—	50
Phillips			
Pasadena, Tex.	—	120	—
Rexall Chemical			
Odessa, Tex.	120	—	—
Shell Chemical			
Woodbury, N.J.	—	—	80
Spencer Chemical			
Orange, Tex.	125	—	—
Texas Eastman			
Longview, Tex.	120	—	20
Union Carbide Plastics			
Institute, W.Va.	—	30	—
Seadrift, Tex.	140	25	—
South Charleston, W.Va.	90	—	—
Texas City, Tex.	200	—	—
Torrance, Calif.	80	—	—
Whiting, Ind.	80	—	—
U.S. Industrial Chemicals			
Houston, Tex.	180	60	—
Tuscola, Ill.	120	—	—
Totals	*1945*	*658*	*485*

*Polypropylene capacity will be included in polyethylene capacity when Hercules completes an expansion of its Lake Charles, La., polyolefins plant.

Source: C&EN Estimates

Polyvinyl Chloride Capacities Continue to Rise

Company and Location	*Capacity in 1961 or 1962, Millions of Pounds*
Union Carbide Plastics South Charleston, W.Va. Texas City, Tex.	250
B. F. Goodrich Chemical Niagara Falls, N.Y. Louisville, Ky. Calvert City, Ky.	275
Dow Chemical Freeport, Tex. Midland, Mich.	40
Monsanto Chemical Springfield, Mass.	125
Firestone Plastics Pottstown, Pa.	100
U.S. Rubber Painesville, Ohio	70
Diamond Alkali Deer Park, Tex.	80
Cumberland Chemical Calvert City, Ky.	50
Goodyear Niagara Falls, N.Y.	70
General Tire Ashtabula, Ohio	40
Escambia Chemical Pensacola, Fla.	40
Borden Chemical Leominster, Mass. Illiopolis, Ill.	40 40
Thompson Chemical Pawtucket, R.I.	75
Cary Chemical Flemington, N.J.	100
Great American Plastics Fitchburg, Mass.	15
Atlantic Tubing & Rubber Cranston, R.I.	25
J. P. Frank Brooklyn, N.Y.	25
Minnesota Mining & Mfg. St. Paul, Minn.	5
Rubber Corp. Hicksville, N.Y.	10
Keysor Chemical Saugus, Calif.	6
American Chemical Watson, Calif.	25
Pantasote Corp. Passaic, N.J.	50
Total	*1556*

Source: C&EN Estimates

Production ran about 25 million pounds in 1960 and should grow at a rate of about 6 to 7% a year—not counting any possible impact from fibers. Capacity is now around 56 million pounds a year, following an expansion round completed last year. Du Pont converts about 10 million pounds of polyvinyl alcohol annually to polyvinyl butyral for use in safety glass.

Vinyl Output Expected To Exceed 1.2 Billion Pounds This Year; Sales, 1.1 Billion

	Consumption, Millions of Pounds		
	1960	*1961'*	*1965**
Polyvinyl chloride and copolymer resins containing 50% or more polyvinyl chloride			
Film (under 0.010 gage)	98	105	140
Sheeting (0.010 gage and over)	127	130	250
Molding and extrusion	285	290	350
Textile and paper treating and coating resins	63	65	70
Flooring	161	180	300
Protective coatings	39	45	70
All other uses	113	120	130
Subtotals	*886*	*935*	*1310*
All other vinyl resins			
Adhesives	59	64	70
Protective coatings	27	30	35
All other uses	124	120	130
Subtotals	*210*	*214*	*235*
Grand totals	*1096*	*1149*	*1545*

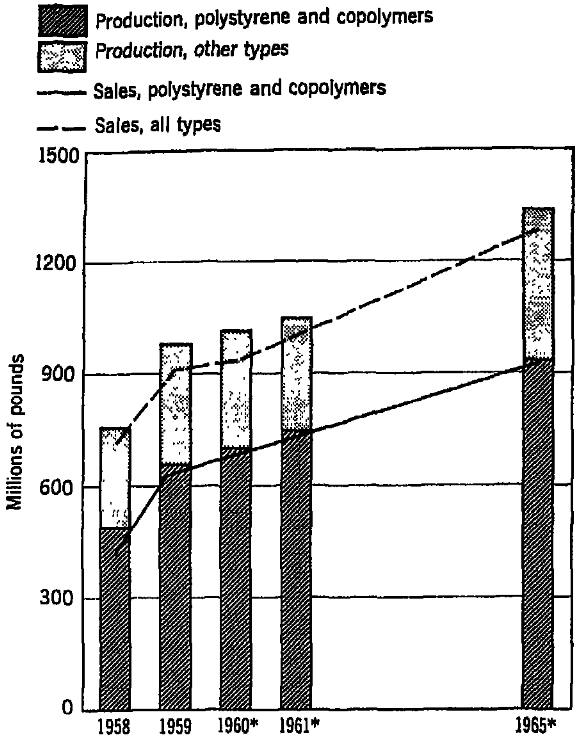
Sources: U.S. Tariff Commission and *C&EN Estimates

Polyvinylidene chloride's major use is as a webbing, and this accounts for about 10 million pounds a year. In the years ahead, this market is expected to lose ground to polypropylene monofilaments.

Styrene

Styrene resins seem ready for another spurt that promises to carry sales well beyond the billion-pound level in 1965. The main impetus should come from growth of copolymer molding resins such as acrylonitrile-butadiene-styrene (ABS), oriented polystyrene film, and polystyrene foam (both expandable and extruded varieties).

Since 1955, styrene resins have set a growth pace second only to that of polyethylene. The reason still baffles the industry, but most observers agree that price is responsible. Between 1956 and 1960, styrene resins sales (all types) increased about 55% to about 920 million pounds. Even more significant, sales of molding and extruding resins during the same period climbed about 75% to about 700 million pounds. In 1965,



Styrene polymers: production and consumption.

sales should reach 910 million pounds. Capacity by 1962 should be 1.02 billion pounds a year.

But the disturbing aspect of this fine performance is the lack of profits. General purpose polystyrene sold for 27.5 cents a pound in 1956, and its price has tumbled several times to a posted 16.75 cents in hopper-car quantities. Even this is not firm, as the trade reports the material moving for 15 cents a pound at times. Reasonable profits are hard to visualize at the present level. Styrene monomer sells for 11.2 cents a pound; conversion costs about 2 cents a pound on the average. To this must be added shipping costs, selling costs, and the like.

Fortunately, profits are better in upgraded materials such as impact polystrene. The impact feature is gained by blending polystyrene with styrene-butadiene rubber. Today, some six or eight varieties of high impact polystyrene are on the market, ranging in price from 27.5 to 37 cents a pound.

Styrene Resin Production for the First Time Surpassed 1 Billion Pounds Last Year

	Consumption, Millions of Pounds		
	*1960**	*1961**	*1965**
Molding materials**			
Polystyrene, general purpose	305	315	350
Polystyrene, impact grades	330	350	410
Styrene copolymers	55	70	150
Textile and paper treating resins	55	60	70
Protective coating resins	65	75	90
Polystyrene film and sheet	5	12	40
Polystyrene foams (expanding and extruding)	40	50	100
Miscellaneous	60	60	80
Totals	915	992	1290

**Exports are included in molding material. These were about 130 million pounds in 1960 and should be about the same amount in 1961. By 1965, they should decline to about 70 million pounds.

Sources: U.S. Tariff Commission and *C&EN Estimates

Acrylonitrile-Butadiene-Styrene Capacity

Company and Location	*Capacity in 1961, Millions of Pounds*
U.S. Rubber	
Naugatuck Chemical division	
Baton Rouge, La.	45
Borg Warner	
Marbon division	
Washington, W.Va.	25
B. F. Goodrich	
Akron, Ohio	15
*Monsanto Chemical**	
Springfield, Mass.	6
Addyston, Ohio	50

*Springfield plant will be operated until Addyston plant is finished in late 1961; capacity includes that for *styrene-acrylonitrile also.*

Source: C&EN Estimates

Much interest now focuses on copolymers such as styrene-acrylonitrile, ABS, and styrene-methacrylate. The ABS resins seem to have the largest market prospect. They are tough, hard engineering plastics with good chemical resistance. They can be made by blending styrene-butadiene rubber with styrene-acrylontrile or by graft, block, series, or other polymerization methods. Consumption in 1960 was about 35 million pounds, and it should increase to 45 million this year. By 1965, consumption could reach 110 million pounds if potential markets materialize.

Important uses for ABS today are in colored telephone hand sets and in pipes. Producers expect strong growth in the automotive markets, such as in instrument clusters, dashboards, and kick panels. In the appliance field, refrigerator door liners could be a large use for ABS. Today, this is a major outlet for impact polystyrene. The key to a switch is use of urethane foams for insulation. Fluorocarbon blowing agents will attack polystyrene but not ABS. On the other hand, perhaps the insulation could be wrapped in a polyethylene envelope and users could stay with impact polystyrene. Other potentially large markets for ABS include boat hulls, luggage, and many smaller uses.

ABS is made by U.S. Rubber's Naugatuck Chemical division, Borg Warner's Marbon division, B. F. Goodrich, and Monsanto Chemical. Capacity is rated about 90 million pounds a year now but will increase later this year. ABS sells for 51 cents a pound today (colored, truckloads). Prices below 40 cents are expected in the future.

The outlook for styrene-acrylonitrile resins, on the other hand, is not as optimistic. Demand ran about 20 million pounds last year and may rise to 30 million in 1965. Styrene-acrylonitrile is a clear, high impact plastic. Present uses include brushes, tumblers, and water pitchers. Growth should come in the housewares and bottle markets. The resin is made by Union Carbide Plastics, Dow Chemical, and Monsanto.

The future for styrene-methacrylate is not clear yet and depends upon weathering performance. The material is designed to compete for markets now serviced by acrylic resins in signs and automotive uses. It sells for 49 cents a pound, compared to 55 cents a pound for acrylic materials.

Quite promising to styrene resin's future are foams and films. Foams for insulation and other uses take about 40 million pounds a year now and could reach the 100 million-pound class in 1965. A significant development in the foam field is the so-called foam films (extruded expandable styrene beads). These are made by Dyna Foam, a division of Sun Chemical, and Monsanto. Others will likely move into this field. The potential ranges from "interesting" to "fabulous." One company explains, "If we could take 4 or 5% of the paper market, we would be

Polystyrene Molding and Extrusion Capacity

Company	*Capacity in 1961 or 1962, Millions of Pounds*
Bran Plastics	40
Cosden Petroleum Division of W. R. Grace	40
Dow Chemical	300
Foster Grant	75
Hammond	5
Koppers	125
Macromold	4
Massachusetts Plastics	12
Monsanto Chemical	150
Plastics Materials	6
Rexall Chemical	70
Richardson	30
Shell Chemical	40
Solar Chemical	40
Ticonderoga	10
Union Carbide Plastics	75
Total	1022

Source: C&EN Estimates

thinking of 400 to 500 million pound-a-year markets." Such thinking is not unreasonable. Typical uses include cups, disposable plates, and packaging. The products are priced to compete with high quality papers.

Polystyrene film will also provide a growing market for styrene resin. Dow, Plax (50% Monsanto), and Visking (Union Carbide) make it now; others probably will shortly. These films can be coated easily and heat sealed. Present thickness ranges from 0.75 to 20 mils. About 7 million pounds of film were produced in 1960, and 12 million are expected this year. This volume might rise to 45 million pounds by 1965.

Nylon Resins

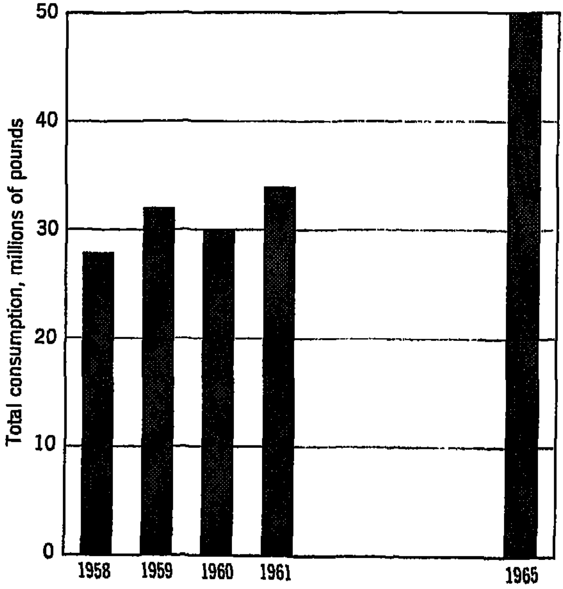
In the plastics industry, some people feel that nylon molding resins could be priced at about 60 cents a pound. The price isn't there yet and shouldn't be by 1965. One reason is that nylon is an engineering plastic for specialized applications. Prices have come down, however, and the lowest level now is 98 cents a pound. A decline to 80 cents a pound is possible by 1965.

Three types of nylon molding resins are made in the U.S. today—the 66 type made from hexamethylenediamine and adipic acid; the 610 type made from hexamethylenediamine and sebacic acid; and nylon 6 made from caprolactam. Perhaps caprolactam nylon will set future prices, although it is only 25% of the business. A reason for this is that all nylon resin producers make nylon 6; only Du Pont makes 66 and 610.

Nylon molding resin capacity is rated at 45 million pounds a year now. Actually, this is a flexible number, since the real limitation is in bagging facilities. Production last year was about 33 million pounds, and this should increase to about 37 million pounds in 1961. Production of about 55 million pounds is expected in 1965.

Consumption is rather close to output and should reach 34 million pounds this year and rise to about 50 million in 1965. Much nylon resin is used in the automotive, appliance, and hardware industries and therefore is sensitive to the business climate.

Injection molding accounts for 60% of the nylon end-use pattern now. By 1965, it should run near 50%. Future growth should depend upon new outlets, since many present uses for nylon resins will face strong competition from other plastics and lower priced plastics in the years ahead. Typical molding applications include gears, bearings, washing machine valves, combs, and automobile dome lights.



Consumption of nylon molding resins.

Monofilaments have played a strong part in the nylon resin consumption picture. A typical use is fishing lines. Nylon monofilament demand should increase some 20% in the next four years. Extrusions for tubing, wire coating, and other similar outlets are expected to grow about 100% to 12 million pounds a year by 1965.

Nation's Use of Nylon Molding Resins Will Keep Growing

Outlet	Consumption, Millions of Pounds 1960	 1961	 1965
Molding	18	20	26
Extrusion (wire coating, etc.)	5	6	12
Monofilament	7	8	10
Film	Small	Small	2
Totals	30	34	50

Source: C&EN Estimates

Nylon film has been a promising material for years but as yet has not made dynamic progress. Output this year might run 100,000 pounds, and it could swell to 2 million pounds in four years—at least, that's a hope. Nylon film is expensive, with 1-mil thickness selling for $1.70 to $2.00 a pound. Surgical packaging is a typical application.

Nylon Molding Resin Capacities

Company and Location	Capacity, Millions of Pounds
Du Pont Parkersburg, W.Va.	30
Foster Grant Manchester, N.H.	3
Allied Chemical Chesterfield, Va.	5
Spencer Chemical Henderson, Ky.	2
Firestone Plastics Pottstown, Pa.	2
Total	42

All producers make nylon 6 resins; Du Pont also makes nylon 66 and 610.

Source: C&EN Estimates

Acetal Resins Subject to Litigation

Simply stated, the big question in acetal resins is this: How will the courts rule on Du Pont's charge that Celanese is infringing on the Delrin patents? The suit, filed in April at the U.S. District Court of Delaware, asks that Celanese be enjoined from making and selling its acetal resins called Celcon. It may take some time before a decision is reached. Meanwhile, would-be acetal resin makers, both here and abroad, will likely keep announcements on the subject close to the vest. Heyden Newport, for one, which said it was in the pilot stage, now has no comment.

However, Celanese says it has not infringed and is building its acetal resin plant at Bishop, Tex. Completion is slated for 1962. Probable output will run about 25 million pounds a year, according to the trade. Celanese says Celcon is made from trioxane (a low molecular weight formaldehyde polymer), and the product is actually a copolymer.

Acetal resins compete with other engineering plastics such as nylon resins, polycarbonates, and ABS polymers. But Du Pont says that 75% of the future market should come from replacing steel, brass, and die cast metals. Prospects now lie in molded and extruded products; not much is said about use for films, fibers, or foams. However, vacuum sheet forming is a possible growth area.

Somewhat over 600 applications for acetal resins are now commercial. Apparently, the auto industry will be the largest user in 1965, taking some 25 to 30 million pounds of acetal resins for various decorative and functional parts. Appliances could take up to 10 to 12 million pounds. Industrial equipment might consume 15 million pounds and other uses about 25 to 30 million.

Delrin sells for 65 cents a pound now (truckloads), having dropped three times from its introductory price of 95 cents a pound. Celcon opened at 70 cents a pound in development amounts. Eventually, the price for acetal resins will go lower, and there is much talk about 30 to 40 cent-a-pound listings. A key to pricing is the value of high purity formaldehyde, now about 10 cents a pound and apparently not subject to much future change.

Du Pont probably produced 5 or 6 million pounds of Delrin last year, its first commercial year. Sales ran between 4 and 5 million pounds. Compared to the history of other major plastics, this is not a bad beginning. Output could reach the 8 to 10 million-pound range this year, with sales running 8 or 9 million. By 1965, output of acetal resins could reach the 80 to 90 million-pound level, with consumption of at least 80 million pounds. Acetal resins seem destined to become big volume plastics in the years ahead. Very long range estimates predict annual volumes beyond 500 million pounds a year.

Acrylics Still Going Strong

Methacrylates are among the oldest plastics, yet demand continues to hum along. Two reasons are their weather resistance and durability. Production was around 120 million pounds in 1960 (which includes plastics as well as latexes and lacquers). They should grow 8% a year through 1965. The most significant uses for methacrylates are for molding powders and cast sheet.

Methacrylate Monomer Capacity Slated to Increase

Company and Location	*Capacity, Millions of Pounds*
Rohm & Haas	
Houston, Tex.	
Knoxville, Tenn.	100 to 110
Bristol, Pa.	
Louisville, Ky.	25 to 30 (late 1961)
Du Pont	
Belle, W.Va.	50 to 60
Escambia Chemical	
No site yet	20 to 30 (early 1963)
American Cyanamid	
Fortier, La.	25 to 30 (early 1963)

Source: C&EN Estimates

Molding powder demand depends upon economic activity in the automotive and appliance industries. About 30 to 33 million pounds should be consumed this year, almost half in the automobile industry, where it is used for taillights, dials, and medallions. Another 10 million pounds went into appliances, chiefly for decorative purposes. Miscellaneous moldings consumed the balance. Molding powder markets should thus consume about 40 million pounds in 1965.

A factor in the future growth is Rohm & Haas's high impact molding powder called Implex. Implex is a copolymer of methacrylate and styrene-butadiene rubber which features high impact properties. It sells for 46.5 cents a pound, compared to 55 cents a pound for other acrylic molding powders. Some 5 or 6 million pounds should be consumed this year and 12 to 15 million in 1965. Additional competition in this area might come from Dow's Zerlon, a methacrylatestyrene copolymer it hopes will find use in the automobile market.

The other important plastics application for acrylics is cast sheet. Demand here is promising and could reach 55 million pounds in 1965, compared to about 40 million pounds this year. The major use here is in signs, panels, and similar items. Growth prospects lie in signs for supermarkets, service stations, and highways, often as replacements for neon signs.

Also in the acrylic resins picture is acrylic syrup made by Du Pont. Du Pont hopes the syrup will gain wide use in the reinforced plastics field. Syrup consumption should run 2 million pounds this year and could exceed 10 million pounds in 1965.

Cellulosics Will Make Only Small Gains in the Future

	Consumption, Millions of Pounds		
	1960	*1961*	*1965*
Cellulose acetate and mixed esters			
Sheets, under 3 mils	19	19	20
Sheets, over 3 mils	21	22	17
Other sheets, rods, and tubes	10	10	11
Molding and extrusion materials	89	89	92
Nitrocellulose sheets, rods, and tubes	1	1	1
Totals	*140*	*141*	*141*

Source: C&EN Estimates

Latexes and lacquers offer bright potentials, too. These are paints with 100% acrylic bases, primarily copolymers of methacrylates and acrylates, as well as paints made from copolymers of acrylates with vinyl acetate or styrene.

Methyl methacrylate monomer is the major raw material for acrylic resins. Du Pont and Rohm & Haas now make the monomer, and Escambia Chemical and American Cyanamid plan to enter the market sometime in 1963.

Polycarbonates Become Commercial

Polycarbonates swung into the commercial line-up last year when Mobay and General Electric began producing them. Both firms have plants with capacities rated at about 5 million pounds a year.

Last year, production was about 2 million pounds with consumption below 1 million. Consumption will reach between 1.5 million and 2 million pounds this year as output rises to the 2 or 3 million-pound level. The forecast for 1965 calls for consumption of about 25 million pounds and indicates an obvious need for more capacity.

Polycarbonates are classed as engineering plastics. They sell for $1.30 a pound now, down considerably from the introductory price of $2.50 a pound. Prices should decline further and could run about 75 cents a pound.

About 80% of present use is in molded products. Typical applications include telephone parts, computer units, electric drill housings, and safety equipment. Extruded and cast products account for the balance of the market. Typical use here is for graphic arts film bases. In the future, polycarbonates might be used in fibers and elastomers.

The fluorocarbon resin business is shaping into a highly competitive area. Allied Chemical is now producing, joining Du Pont and 3M, and Pennsalt is about to start. Allied's and 3M's plants have capacities of less than a million pounds, and Pennsalt will likely have similar capacity. Du Pont's capacity is about 15 million pounds a year.

Last year, production of fluorocarbon plastics was about 12 million pounds, and sales were near 10 million. Output should run 14 million this year, sales about 11 million. By 1965, production could reach the 40 to 45 million-pound level.

Best known of the fluorocarbons are Du Pont's Teflon TFE resins. These sell for about $3.25 a pound now and could go down to between $1.50 and $2.00 a pound by 1965.

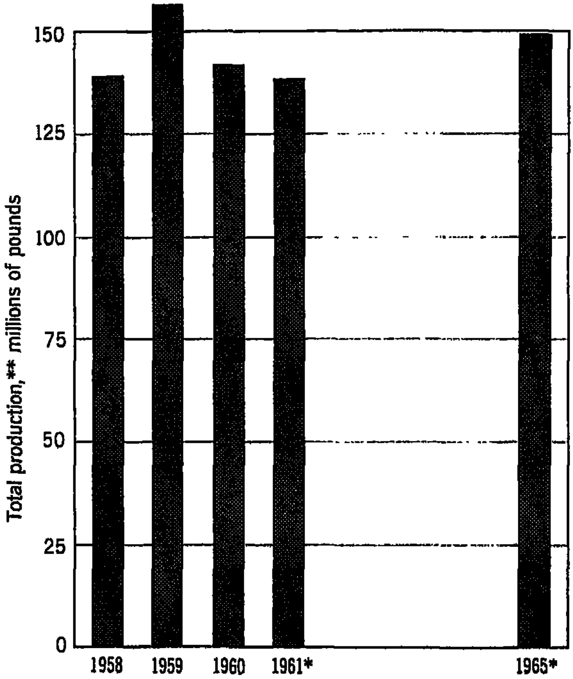
About 75% of today's fluorocarbon output ends up in extruded products, about 20% in compression molding. Film, fiber, and coating uses are quite small now but hold promise in specialized uses. Electrical and electronic equipment took 30% of the fluorocarbon output last year, and wire and cable jacketing consumed about 25%. Automobile uses average 0.05 pound per car now, based on six applications. By 1965, there might be 12 to 15 applications.

Also bracketed in the halogenated plastics picture are Hercules' Penton resins. These are chlorinated polyethers based on pentaerythritol. Hercules makes them at Parlin, N.J.; capacity is 2.4 million pounds a year. They are used in pipes, pumps, and processing vessels to provide corrosion resistance. About 30% of the resin is used in coating applications and another 30% in injection molding. The balance goes into extrusions to line steel pipe, tubing, and the like. Coatings based on finely ground Penton are expected to make major gains in the future.

Cellulosics (acetates, butyrates, and propionates) have reached maturity, and little growth can be expected. Demand may even turn down as other plastics, such as acrylonitrile-butadiene-styrene polymers and polystyrene film and sheet, continue to make inroads on cellulosic markets. A hope for some future growth lies in blow molding; more will be known about this in a year or so. Total cellulosic demand in 1965 should run about 141 million pounds, about the same as in 1961.

The molding market is the largest outlet for cellulosics. Typical products include automobile steering wheels, shoe heels, and telephone hand sets. Molding grade cellulosics sell for about 40 cents a pound, and if anything, the price could rise by 1965. Consumption of molded and extruded cellulosics was 89 million pounds last year and should run the same this year. For 1965, it might be 92 million pounds.

The film market will do well to hold its own through 1965. Cellulosic sheet consumption has been virtually level for the past few years, and by 1965 demand is likely to decline.



**Sales essentially equal production

Production of cellulosics. (Sources: U. S. Tariff Commission and *C&EN Estimates.)

A marketing program is an integrated series of marketing efforts, involving many aspects of the business, and comprising a *system* of performance as opposed to just one part of a system. Thus, market research is just one small part of a marketing program; the selection of the proper channel of distribution would be another. All too often, unfortunately, the various subsystems or subfunctions necessary to the development of a commercially successful product are not directed toward a common end. For example, the advertising and publicity department will commonly offer items for sale before they are "ready"—too, the laboratory will develop a product that is technically excellent for a specific function but which is too costly to compete with other products that perform the same function.

In this article, the author presents the entire marketing *program* for a new plastic material. He points out quite clearly that *all parts* of the firm's (Du Pont's) marketing activities must be conducted in such a way as to maximize the opportunities for the success of the new product. Thus, it is not sufficient for the market research group to make a sales estimate—the activities of the product development department must be directed toward providing a product that optimizes the opportunity for success, and management must select the best potential market from a number of alternatives. In addition, management must look ahead and determine what prices, distribution channels, products, profits, etc. will be "best" at some time in the future. Only when the activities of the present and of the future, in terms of the actions of various departments such as market research, sales, and product development, are tied together so that each contributes toward a common end, and not just to the glorification of that particular department can it be said that there is a *marketing program* and not marketing chaos.

7 Design of the Marketing Program for a New Product

by G. T. Borcherdt

Before getting into the aspects of designing a marketing program for a new product, I thought it might be well for me to give you a little background about the kind of business in which we are engaged in the Polychemicals Department of Du Pont. This may help you recognize why I'll be somewhat vague in some areas that perhaps are of major concern to you, and on the other hand, appear to go overboard in considering some of the finer points related to our problems, not necessarily of great concern to you. I hope, however, that I adequately touch on the significant points because my main objective in this presentation is to relate them in a fashion that describes an integrated program.

Our Polychemicals Department manufactures and markets "Zerone" and "Zerex" anti-freeze, a wide range of agricultural chemicals and various bulk chemicals such as adipic acid, methyl alcohol, and ammonia. On the plastics side, we are heavily involved in the polyethylene business, in fluorocarbon polymers, and a variety of nylon and acrylic plastics resins. We produce some semi-finished forms as well as finished forms of plastic products.

For this discussion I have chosen the plastics area for considering the design of a marketing program for a new product. I feel that here we can delineate specific factors in a very orderly and common-sense manner—and in addition we are dealing with what is now a profoundly important area in coming to grips with commercialization of new products.

In Figure 1 I have depicted in simplified form the sequential flow of materials as a plastic is produced, shipped to a customer for molding or shaping with the shaped object then following typical channels until it reaches its point of ultimate consumption or use. You will note that I have made a basic distinction between uses of the product that end up in producer equipment and those that are ingredients of consumer items. Depending upon the extent of this split, the over-all product involvement can be profoundly influenced, because, as you well know, consumer

Reprinted with permission from R. L. Clewett (ed.), *Marketing's Role in Scientific Management* (Chicago: American Marketing Association, 1957), pp. 58–73. Dr. Borcherdt is Manager of the Marketing Analysis Section of the Polychemicals Department at Du Pont.

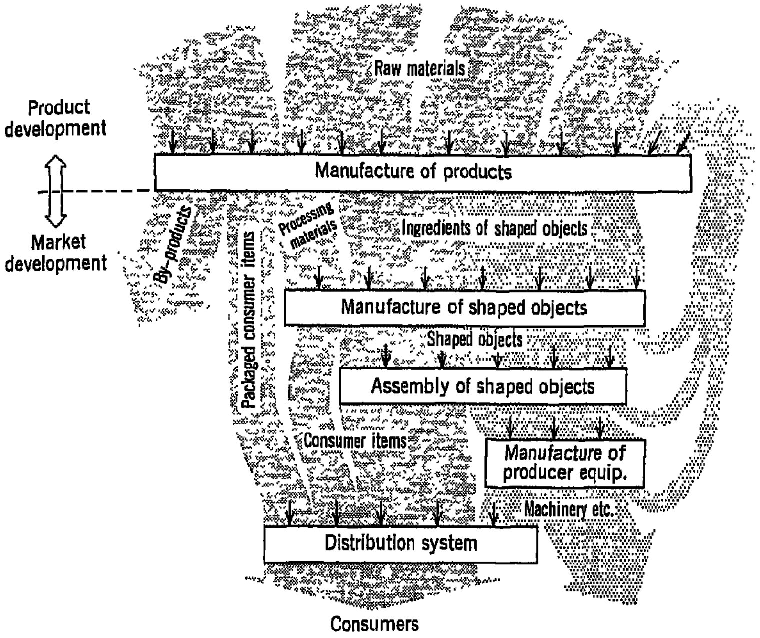


Figure 1. Typical flow of plastic product.

goods purchases and capital goods purchases can be and very often are markedly out of phase. I have flagged this in the diagram by showing that the machinery involving the product ceases to flow at the point at which it is used, whereas the ingredient portion of the consumer item flows beyond this point. Although not shown in this simplified diagram, producer equipment, of course, can and usually does flow into the various other stages of manufacture—in this connection I have shown items produced by the customers, and their customers in turn, flowing back to the basic manufacturer of the product. This, I feel, can be a very important point to recognize inasmuch as valuable information can be obtained within your organization as to performance of items made from your products. You will find as I go along, that recognition of factors involved in the distribution through the stages indicated on this chart become principal points in my discussion, in particular the end-use factors involved. Also the factors shown on the left-hand side of the chart involving product development needs become important to recognize in the over-all design of the marketing program as these factors relate to the market development segment of the program.

Now, since I have selected a new plastic product for the discussion, let's take a look at what's been happening to plastics. Figure 2 shows the history of plastics resins growth. This is an arithmetic scale in which the quantity in pounds for 1956 was a little over 4 billion and in dollars about 2 billion. Now, some pretty learned gents did a little projecting back in 1942, and look what they came up with. How wrong can you be by relying on historical trend projections? The point which I want to emphasize here—and as a matter of fact this is the heart of my whole presentation—is that in designing our program we must consider primarily what it is that can be achieved as a result of bringing this product on the market rather than simply transcribing what has happened in the past to other materials that we have chosen to call plastics. I think you will find that the approach constitutes fundamentally the application of straightforward common sense, although there are undoubtedly some pretty knotty problems to face in developing the various components of the program and what can be achieved by it.

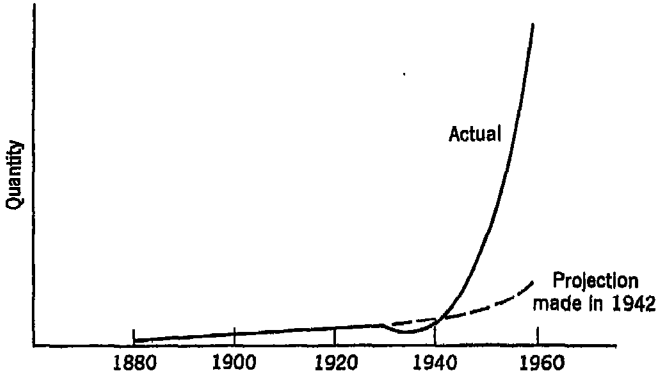


Figure 2. History of growth of plastic resin.

To set the stage, I have shown in Figure 3 the basic factors to be considered. Obviously, it is necessary to predict quantity of sales we feel we can realize as time goes on, and the key factors in achieving these will be how we expect to deploy our effort in the marketing program—and resulting from this, whether or not it is worth while. In other words, can we predict an attractive profit position in relation to the effort required?

Conrad Jones has just covered the importance of new products to maintaining a healthy business these days—so let's assume we have a candidate new plastic resin and tackle the job of setting the stage for decision on commercialization. Naturally, the first question we ask as

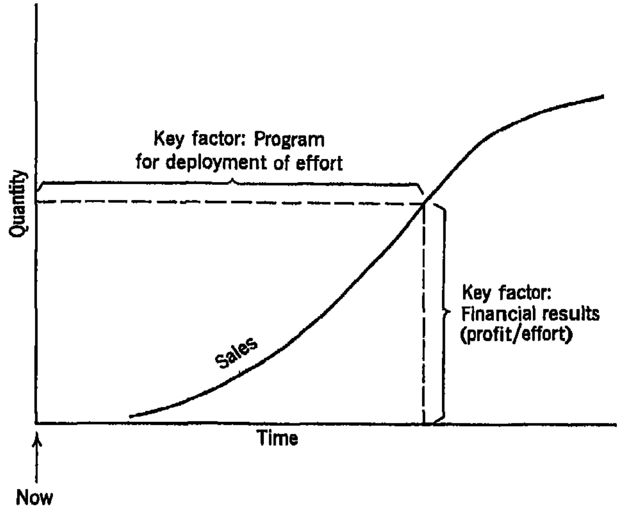


Figure 3. Base factors in design of marketing program for the new product.

the new plastic emerges from the test tube is "what's it good for?"—so, in Figure 4 I've shown a quantity bar which describes, and I emphasize the word "describes", the extent to which the product is technically suitable for use—or more simply what can you make out of it and how much would be required if you made these things out of it? In doing this we must consider specific end uses, and since we are considering

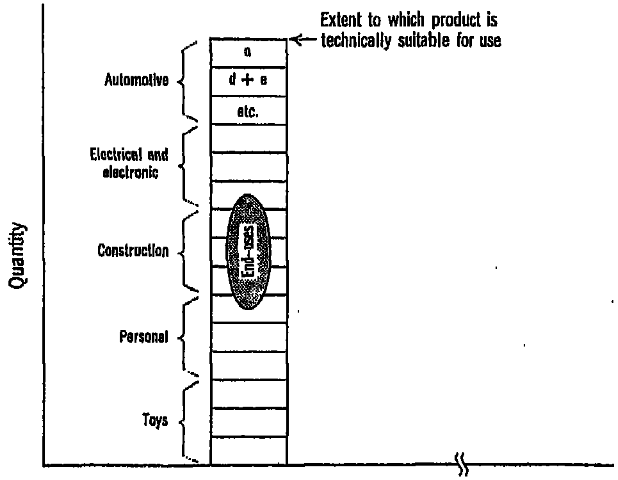


Figure 4. Size of market possibilities.

whether or not it is worth while to commercialize the product, the size of the markets for these end uses must be built up. Since our tools for doing this are statistical data available from government and trade association sources and the like, it is inevitable that a first broad cut will fall into typical industry categories of the type I have shown on the left-hand side of the bar. Now, of course, if we don't build up much of a bar here, it is unlikely that we should be faced with designing a marketing program.

We are undoubtedly going to be competing in many of the end-use areas with other materials either now being used or, though not yet on the market, also technically suitable. And so, we immediately start matching this new product against these other materials to judge where

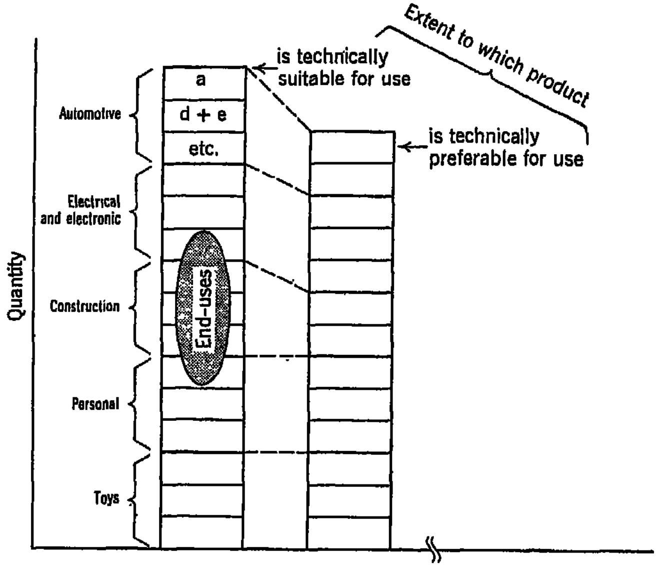

Extent to which product
is technically suitable for use
is technically preferable for use
Quantity
Automotive
Electrical and electronic
Construction
Personal
Toys
a
d + e
etc.
End-uses

Figure 5. Size of market possibilities.

the new product will do a better job. In Figure 5 I have added, therefore, a second bar depicting the extent to which the product is technically preferable for use. Now, I want to emphasize at this point that we have not yet come to grips with the costs associated with the use of the product. We're just trying to find out where, because of its end-use properties, it will do the best job. You will notice I've dropped out some of the end uses in two areas—the automotive and the construction areas as a possible typical situation faced with a new plastic resin. Thus, it may be possible to use it for a structural part, but if you really had your choice, and cost was not a factor, you would prefer to stick with steel or concrete, or possibly even wood. Now, I think this second bar with the data backing it up is a pretty important piece of information to have around—it's an important guide to indicate incentive for doing research and development to overcome cost barriers involved in the use of the product. It tells you what could be fair game for sales efforts in the event that you could do something about costs.

But we haven't considered costs yet and we still have a ways to go in making up our minds as to what we should be able to do in the way of sales if we commercialize this product. So, let's take a next step and consider the impact of selling price on the size of these market possibilities.

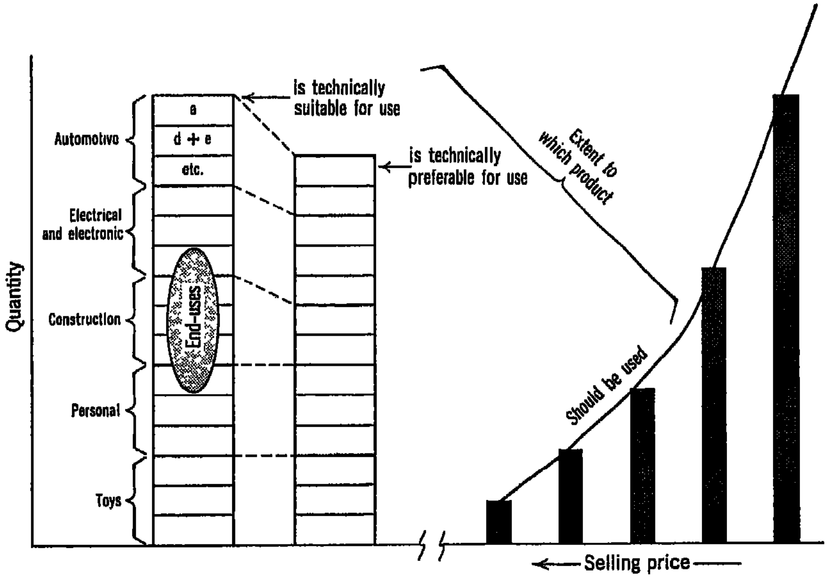


Figure 6. Size of market possibilities.

In Figure 6 I have added to the picture the market size depicting the extent to which the product should be used over a selling price range. Here is where the problem really gets complex because you will remember from the first slide that a plastic resin can go through several stages of fabrication before its real value as a potential end product has been assessed. Basically, the economic aspects of utilizing this material must be built into the over-all picture in order to build the bars of "should be used" over the "selling price" range. The bar to the far right is, of course, equal to the far left bar, since at sufficiently low selling price the product should be used wherever it is technically suitable for use.

Now, at this point I want to emphasize that in no way do these quantities representing size of market possibilities tell us how much we can expect to sell. We still have quite a ways to go before we are ready to tell our management how much we expect to be able to sell. These quantities, documented by the data used in their development, basically provide us with a tool—and possibly one of the most basic tools—to start considerations of the design of the program with its attendant expected sales result. In the next series of slides I am going to try to depict the basic framework in which this information behind the "should be used" bars fits with respect to consideration of various alternative courses that we could take.

In the first figure of this series (Figure 7) I have switched around the ordinates of the last slide showing the line of the "should be used" against "selling price" with selling price on the vertical and volume on the horizontal ordinates. In Figure 8, I've detailed the end-use market pattern by the various market areas associated with the built-up volume. Thus, at a high selling price we may have a single use in the automotive area and perhaps a couple of end uses in the electrical and electronics area where the specific properties of this new product have high economic value. Particularly in the construction, personal, and toy areas other competitive products beat out our new product if it must sell at a relatively high price. But as we go down in testing the effect of selling price, D and E uses, or use areas, come in in addition to the A, B, and C areas —nothing more emerges from the electrical and electronics area, but an F use pops up in the construction area—still no personal or toy items, but these later come in as we go down to relatively low selling prices, and of course build up rapidly to very high volume levels, perhaps throughout the entire market area.

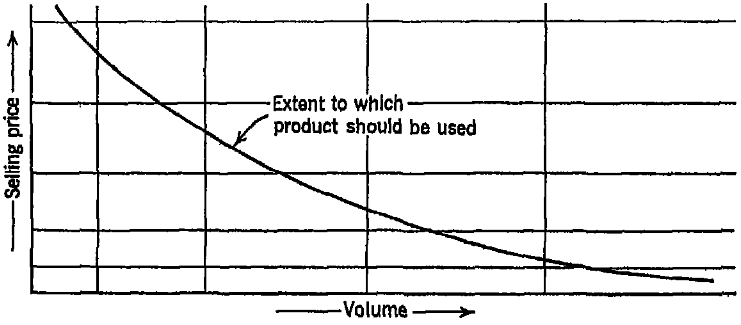
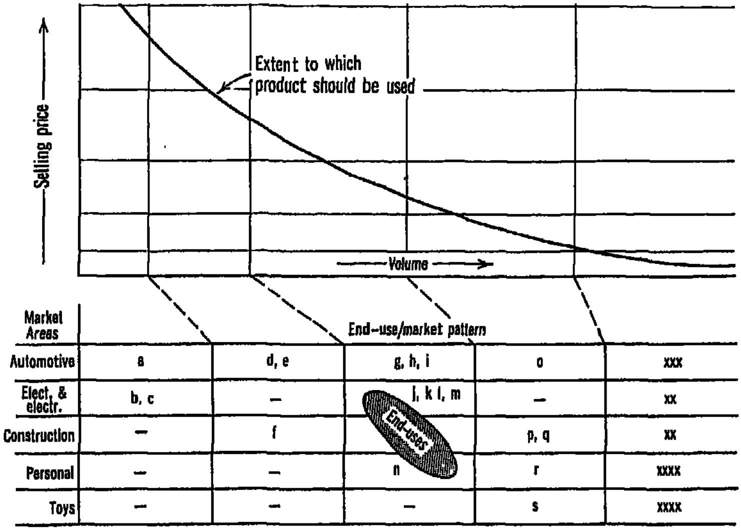


Figure 7. Framework of market possibilities.



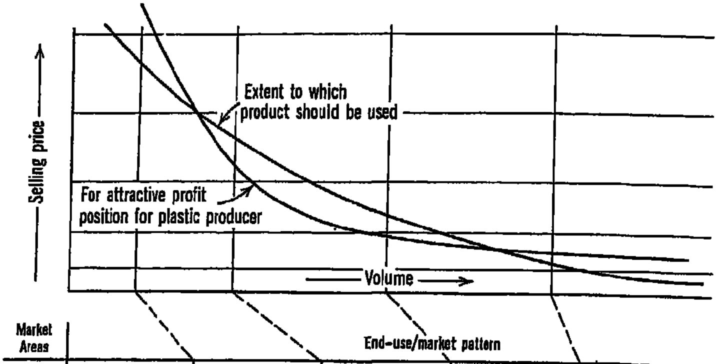
Market Areas					
Automotive	a	d, e	g, h, i	o	xxx
Elect. & electr.	b, c	—	j, k l, m	—	xx
Construction	—	f		p, q	xx
Personal	—	—	n	r	xxxx
Toys	—	—	—	s	xxxx

Figure 8. Framework of market possibilities.

Now, I feel we are starting to recognize some factors basic to the design of a possible marketing program for this new product. But, as yet I've shown nothing that gives us a clue as to whether it could be attractive for us as a producer to put the product on the market. Undoubtedly, while we've been building this market possibility picture we have been developing cost and investment information on manufacture of the product, and we probably have a pretty good idea of what it's going to cost us to manufacture. Moreover, it is likely that the unit costs and unit investments in production facilities will be quite sensitive to scale, particularly at the early stages of volume growth.

In Figure 9 I have added the typical line relating volume of production to selling price for an attractive profit position for the producer of the plastic resin. As indicated, this figure depicts a region of mutual incentive when you relate the line on extent to which the product should be used in the market with the attractive profit position line. In graphic form, it depicts whether or not there is likely to be mutual incentive on the part of potential users of the product and on the part of the producer for commercialization. If these lines don't cross, it seems quite unlikely there is any sound economic reason for putting the product on the market.

Perhaps you can now see my reason for associating the lower portion of the chart on end-use market pattern with this selling-price volume



Market Areas					
Automotive	a	d, e	g, h, i	o	xxx
Elect. and electr.	b, c	—	j, k, l, m	—	xx
Construction	—	f	End-uses	p, q	xx
Personal	—	—	n	r	xxxx
Toys	—	—	—	s	xxxx

Figure 9. Framework of market possibilities and area of mutual incentive (producer vis-à-vis user).

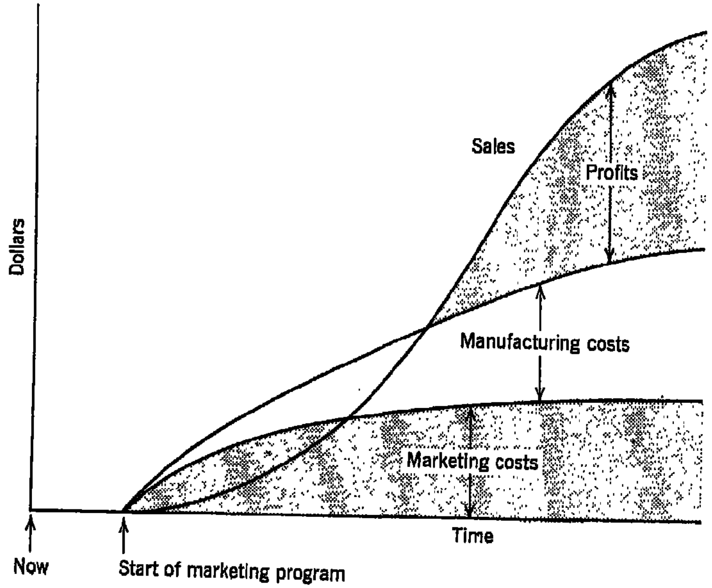


Figure 10. Sales versus cost.

picture. We immeditaely begin to get some clues as to the nature and kinds of end uses on which we can put marketing effort and expect enthusiastic response in the market areas depending upon our pricing plans. Of perhaps greatest importance it indicates the order in which we will promote uses with the recognition of planting the seeds for future promotions as selling prices may trend down with increased volume of production. However, bringing this up at this stage is really premature because we have not yet come to grips with deciding what our sales volume can be in the face of these opportunities, and whether or not we can capitalize on them will depend upon the effectiveness we can achieve in a marketing program.

Referring again to Figure 3, we must put together the program for deployment of effort in terms of cost in relation to the profit to be realized by achieving sales. Another way of putting it, shown on Figure 10, is that if we start a marketing program we must within a reasonable, or let's say acceptable time, reach the point at which sales dollars are sufficient to cover our marketing costs, our manufacturing costs, and provide us an acceptable profit. I have shaded the profit area and the marketing cost area as they are the key points in today's discussion. Arriving at manufacturing costs is usually straightforward, and we are likely to know these within acceptable limits.

I've said nothing yet about predicting or, to use the more common term, forecasting our sales. Actually, we still are not in shape to forecast. There are likely to be more market possibilities than we can possibly go after within the limitations of our marketing facilities. Consequently, we must select from the alternatives facing us, and it behooves us to consider very carefully the costs of attempting to develop the various markets in order to select the most attractive approach. Accordingly, on Figure 11 I've translated the previous slide into one depicting profit-effort relationship showing typical components of a marketing program for a plastic resin which add up to a total marketing cost which must be related to the total profits derived from sales volume achievable.

Considering the components of the marketing costs, we will, in the event we commercialize, undoubtedly have continuing costs associated with research on improving and modifying the product—I have indicated this on the slide as product development cost. There will be costs connected with working out how to fabricate the end-use items, inevitable, even though we may not be making the actual end-use item ourselves. Our salesmen will be working with the customers, such as molders and extruders, whose customers may be assemblers, as indicated on my first chart. Thus, there will be what I've called here customer development costs. There will also be distribution costs. There can, obviously, be wide variations in the compositions and costs of these individual components depending upon the particular end uses involved and how we choose to engage in the market. For example, our immediate customers for a bag of molding powder may, in a captive sense, carry right through to the end-use area in some uses, and we therefore may have very minor costs involved in end-use development with some uses. In some areas a great deal of work may be required in this end-use area, with our immediate customers merely picking this up with very little effort on their part. Or, if the end uses are predominantly in areas where a significantly new distribution approach must be involved, perhaps even to the extent that we have to be organized to handle distribution, this area may be of particular importance. Plastic pipe is an example here, where, if we elect to manufacture and distribute pipe and are not already in the pipe business, we will have real additional distribution costs. My point here is that the specific end uses must be studied individually and the profit to result from efforts required related in order to decide on our marketing program. Inevitably we will find that there are possibilities for

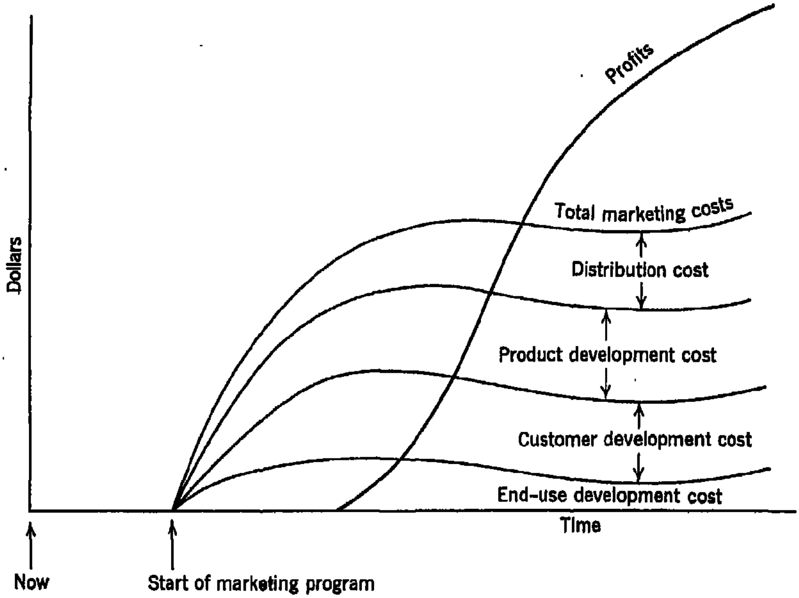


Figure 11. Profit/effort.

selling the product, some of which might be quite substantial in volume, but in which there is not a very attractive profit-effort relationship, at least for early market development.

So, let's assume that we have really "cased the joint"—looked over the various alternatives for sales possibilities—and have decided within the individual areas what we could accomplish if we go out to develop these areas. On Figure 12 I have put together these data from the standpoint of volume, where the bar shows the market possibilities—that is, the extent to which the product should be used at the initial selling price. The faint segments of the stacked line chart indicate, in an accumulative fashion, what we believe we can accomplish as time goes on in each of these end-use areas to give an over-all framework of total sales possibilities. Then, through a selection of the most attractive ones from the standpoint of profit in relation to effort, we have finally arrived at an estimate of the sales that we believe we can realize from our proposed marketing program involving the various components of product development, end-use development, etc. Finally, we have made a forecast—but you'll notice I've merely called it an estimate of sales—it can only become a forecast upon decision to commercialize.

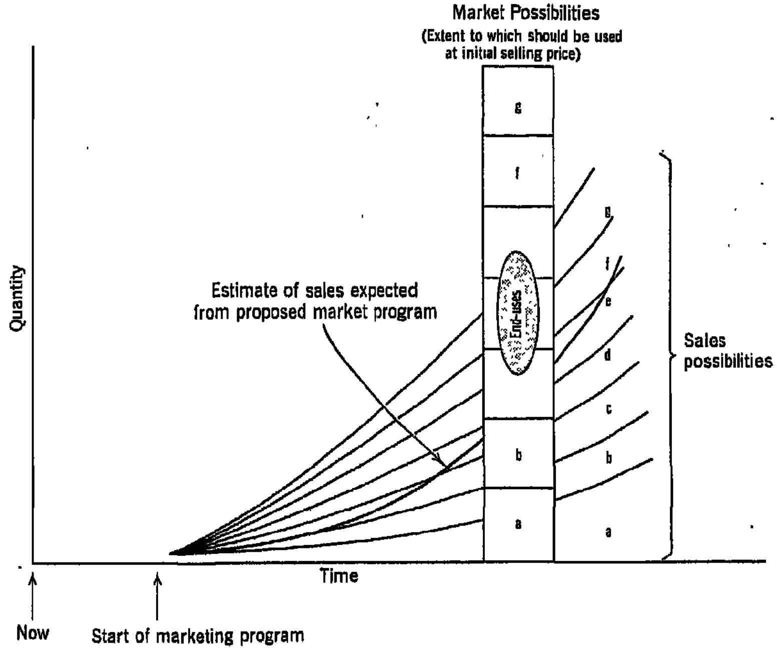


Figure 12. Projected sales result.

Well, that covers a lot of territory and obviously a great deal of soul searching and rather precise considerations. We have a marketing program to propose to our management with the sales volumes to be expected and the profits to be expected. At first glance, it looks like our job is done, but I would like to bring up one further point which I feel is very important to recognize and build into the initial marketing program for this new product. The cost of doing it must be a component of the over-all marketing costs predicted. This is that we had better be sure that we have built into our program the procedure for a continuing evaluation of the progress of the venture. Although we have done everything within our power to predict results and plan our efforts, there is no question but that we will face road blocks, and that as new information develops, we may have to make some rather profound changes in the way we operate as we go along. In other words we need to project while formulating the initial program, the procedure and the facility with which to carry out the procedure of continuing analysis of market position.

On the last figure (Figure 13) I have summarized the sales volume considerations previously developed but shown now in the form they will take if we commercialize the product and build its market. What

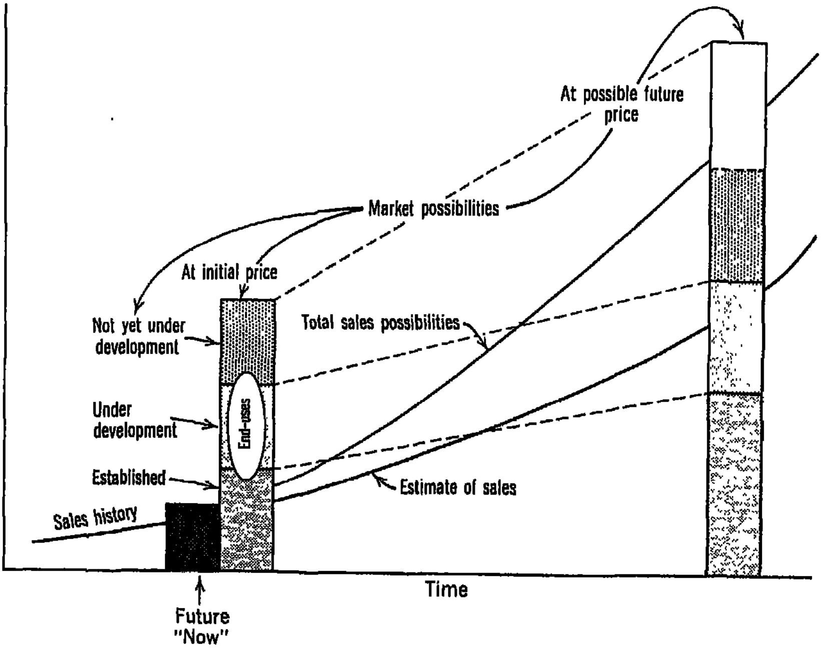


Figure 13. Position in event commercialization undertaken.

I've done here is to "straw man" the position we will be in in the future (as indicated by the future "now" legend on the drawing) from the standpoint of the marketing analysis requirements to assist the marketing organization in its continuing marketing decisions. Thus, I've divided our market possibility bar of extent to which the product should be used into 3 inevitable areas—namely, size of possibilities in uses already established, those under development but not yet established, and those not yet under development but still conceptually sound. Just as we are now faced with projecting the position we will be in as to initial selling price at the time of commercialization, we will at this future "now" time be faced with projecting a future market possibility at a possible lower price as scale of production may increase, and so the bar at the right of the figure indicates this situation. I have flagged again the total of sales possibilities in the light of these market possibilities, and have assumed we're up to date on the attractive areas to go after, and therefore, have put in the estimates of sales expected.

Now, you may ask why bother to show this future position requirement for analysis at the time we're designing the initial program? My reason is this—any continuing program on a new plastic resin comprises deployment of field salesmen to extend sales in established uses, the deployment of development technologists to get new markets started and, inevitably, the involvement of research and development technologists to test ideas and concepts for market soundness. And so, the opportunities to which these three stages of development are cued are separated out in my chart. Of course, to be able to do this we must build into our marketing program an analysis procedure which will give us adequate knowledge of the stages of the end-use developments—and we'd better have it, with its costs, built right into our initial design.

Well, I hope I've been able to lead you through my maze. Quite obviously what I have shown is a marketing analysis—also, quite obviously, no single organizational segment of a marketing team can do the entire job. A variety of skills and experiences are required. In fact, what I have attempted to depict is the result of the entire marketing team's deliberations. Much of the factual market data can be developed by staff marketing research or marketing analysis teams, but ultimately it takes the operating marketing people to say just how they will do it and what it will cost, and this is as it should be—they will be responsible for achieving the result and, accordingly, in my opinion, should say what they expect to achieve. The design of the marketing program for a new plastic product must certainly be a team effort.

A new firm entering a highly competitive field has especially severe problems of survival and growth. Basically, the question is, "How shall we beat the established firms at their own game?" One method of market entry is to orient the chemical firm toward satisfying the needs of potential customers—to develop a product line that the firm's customers can profitably use. This is counter to the CPI's traditional approach of developing a customer for an *existing* product. The former approach, recognized in American industry only within the past five years, is called the "*marketing concept.*"

This article shows how AviSun, a joint venture of American Viscose and Sun Oil, is utilizing the marketing concept to enter the highly competitive polypropylene market. By working closely with its customers, and aiding them to develop and produce a better end product from AviSun's polymer, AviSun expects to create a profitable market position. This implies, of course, that AviSun's readiness to help its customers carries to the extent that AviSun will continue to develop polypropylene resins suited to customers' needs.

8 AviSun Builds Polypropylene Markets

from Chemical and Engineering News

AviSun, with a new polypropylene plant coming on stream later this month, figures now is the time to beat what could become an overcapacity problem for polypropylene producers by 1965. How? By orienting itself toward markets and not, as the chemical industry typically does, toward the product. AviSun feels that the battle for 1965-66 profits is being fought now.

AviSun wants to be a major factor in polypropylene, aspires to sell out all it can produce and keep it sold out. This won't be easy for a new company, even for one with such well-heeled parents as Sun Oil and American Viscose. Its products, polypropylene resin and film, are new to

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the plastics field. Although polypropylene has lots of promise, it also is made by lots of other producers. Most of these producers, or the firms they've tied up with for marketing, are old hands in plastics.

AviSun, being a new firm, has no plastics experience of its own to draw on. But it does have an inheritance. From parent Sun Oil, AviSun got technical know-how; from parent American Viscose, it has marketing skill picked up in the rough-and-tumble rayon business.

Fast Start

Sun Oil's know-how got AviSun on its feet quickly, enabling the company to turn out polypropylene at a rate of 25 million pounds a year within six months after it was organized. AviSun leased half of Koppers' polyethylene plant at Port Reading, N.J., and modified it to make polypropylene. Sun Oil's lab process for polypropylene was scaled up directly to full plant size. Koppers personnel operate the plant; AviSun personnel, who maintain technical, formulation, and quality control, had to set specifications for the commercial product even as the plant went on stream. (When AviSun's plant at New Castle, Del., goes on stream this month, it will add 100 million pounds of capacity.)

Meanwhile, AviSun went to work on marketing policy, decided to commit itself from the beginning to creating demand for its product. Every pound of its first six months of production was deliberately invested in new applications.

AviSun also resolved to help develop the whole range of polypropylene potential—to offer film and fiber as well as resin, says Dr. Paul Moeller, AviSun's marketing director. So, it decided to establish a product manager for each of these. These managers, alone and in concert, set up product specifications, marketing aims, and sales goals for the products under their wing.

This marketing philosophy means AviSun had to find and hire top men for top marketing and sales jobs. It looks for men with roots deep in the plastics business, offers them the excitement and opportunities of a new company and a new product. It also means that AviSun has to hire men with technical degrees for sales jobs. To create markets, it has to lean heavily on sales personnel who can work with customers in the plastics industry—the molders, the fabricators, even the firms that use the end product, such as bakers who wrap their bread in polypropylene.

Such an ambitious marketing setup looks good on paper. Will it work? With a couple of successes under its belt, the company is reasonably sure that it will.

Take the case of the bread wrapping market. AviSun's technical service force, which spends 60% of its time with the end user, developed, designed, built, and sold (at cost or slightly above) machinery to handle its polypropylene film. Then its technically trained salesmen went into the field to help bakeries get started using the new film and new machines. They are available to return quickly at the slightest hint from customers. No delays were permitted in taking care of customer needs in this market, where wax paper, cellophane, and other well entrenched plastic films are competing in a market that adds up to 250 million pounds per year.

AviSun feels that ultimate growth in film will be toward oriented film rather than the unoriented film now being sold for bread wrapping. It will soon be supplying film that stretches in only one direction for wrapping produce. Early next year, it plans to market a biaxial film (no stretch in either direction) for wrapping such products as cigarettes, stationery, cards, and textiles.

Plastic Furniture

But it's in the furniture field that AviSun feels it has really demonstrated its market orientation.

It has been listening to the furniture industry's own critics decry the high cost of furniture. Such costs, say these critics, require that pieces have a long life if the original cost is to be amortized reasonably. Styling, in turn, is affected, because home-owners approach furniture conservatively, shop for pieces that are just right for now and won't look passé in the long years ahead.

With wood becoming scarcer and population increasing, AviSun figured that plastics might be the answer. Plastics are not only less expensive but they can be held to closer tolerances than can wood. AviSun then plunged ahead to develop furniture with freshness, utility, comfort, and up-to-date styling.

AviSun technologists worked with Alladin Plastics, Inc., Gardena, Calif., to develop an injection molded chair. Alladin is now making both side and arm chairs in a single, one-shot injection molding. There's an average of 3.5 pounds of polypropylene in each chair. With Alladin expecting to sell a million of these chairs next year, AviSun has a tidy market for 3.5 million pounds of polypropylene in this outlet alone in the coming year.

The injection molded chair is only a forerunner of this whole new furniture manufacturing philosophy, and AviSun is out to get a substantial share of this market for itself.

Astute Pricing

But AviSun doesn't intend to wait for the market to develop itself. The company plans to make it happen by astute design and pricing of the end product for a mass market, according to sales manager E. M. Irish.

Another lever is new products. In recent months, AviSun has introduced five new grades of polypropylene and has two or three more up its sleeve for introduction about the time the New Castle plant goes into operation. One already on the market is Oleform, a modified polypropylene with high rigidity and heat distortion values, good dimensional stability, and creep resistance. A good insulator, Oleform is expected to find use in electronic and electrical applications. A flame retardant grade of Oleform is to be introduced shortly. Four impact grades of polypropylene have been announced by the company in recent months. Two of the new grades are for injection molding, one is for blow molding, and the fourth is a sheet-grade polymer.

The injection molded chair is only one of the markets AviSun is developing in the area of big moldings that take large amounts of polypropylene in one gulp. Some of the others for which the company itself has developed the technology are refrigerator boxes, air blowers and humidifiers, laundry sinks, and pipe.

AviSun is making polypropylene pipe resin, hopes to develop mileage uses for pipe in Africa, Europe, and the U.S. Polypropylene pipe has excellent stress and crack resistance, can be used in domestic hot water lines if building codes permit. Trailer homes and those in rural and suburban areas beyond the reach of outmoded building codes are a potentially big market.

But AviSun isn't sticking strictly at home. It has licensed a Japanese firm to make polypropylene. It is also planning a world-wide network of about 30 distributors. It already has marketing agreements with, among others, the government-owned distribution organization in Israel and with Getz Bros., which is a large distributor of chemicals in Mexico and the Philippines.

One trend, quite marked in the 1950's, was for firms that were traditionally outside the chemical industry to diversify into chemicals. Thus, firms which had previously devoted their efforts to shipbuilding, manufacturing clothing, etc. invested large sums in chemicals. Typically, these companies sought to capitalize upon the chemical industry's supra-normal growth and profit rate (with respect to the general economy); in addition, the fact that technical know-how is often easy to purchase in the CPI lessened some of the problems of market entry. While the CPI no longer holds the same degree of attractiveness to enterprises seeking diversification, since overcapacity and price competition are more of a problem today than ten years ago, profitable diversification opportunities do exist.

A large "outside" company which invested heavily in chemicals during the 1950's, and which continues to do so, is National Distillers and Chemical Corporation (*previously National Distillers Products Corporation*). Opening its first chemical plant in 1950 (sodium and chlorine), National has since diversified into agricultural chemicals, polyethylene, etc. by acquiring existing companies and developing its own products and processes. In 1962, out of total corporate sales of 775 million dollars, chemicals accounted for 140 million. The latter figure represented a plant investment of more than 200 million. The following article relates the history of the early stages of National's diversification program.

9 Distiller Adds a Big Kick—By Moving into Chemicals

from Business Week

National Distillers Products Corp. is going far afield from the potable liquor business. Thanks to a broadening program of chemical research directed by Vice-Pres. Robert E. Hulse, National Distillers is one of the country's fastest growing chemical companies.

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In the next few months, several new plants will go into action with important new products: isosebacic acid, titanium, zirconium, and others. By the end of 1957, the company should be drawing 40% of its operating profits from sales of chemicals, metals, and products allied with both fields.

And the day shouldn't be far off—perhaps as soon as 1960—when National Distillers crosses over from being the nation's third largest distillery with a chemical sideline to being principally a chemical complex with a gin and whiskey business on the side.

Transition

The metamorphosis began only eight years ago, although the company had played in a small scale on the fringes of the chemical industry even earlier.

From the company's founding in 1924 until his retirement in 1948, the late Seton Porter ran National Distillers as a one-man show dedicated to the liquor business. He allowed a little dabbling in chemicals.

In 1925–29, National was partner of du Pont in Eastern Alcohol Co., a producer of industrial alcohols, carbon dioxide, and glycerin.

In 1925, too, National pioneered in petrochemicals with a half-interest in Petroleum Chemical Corp. The company made synthetic alcohols and solvents from the gases of the petroleum cracking process.

Despite these excursions into chemicals, Porter and his management were convinced that whiskey offered the greatest profit potential—despite prohibition. National's principal business was then in industrial alcohol. But, believing that repeal of the 18th Amendment was inevitable, Porter set the company to building up a tremendous inventory of whiskey. This required cash, so National Distillers sold its interest in Eastern Alcohol in 1929 for $16.5-million. It didn't get back much into chemicals until Porter retired in 1948.

Whiskey Sours

Sales and profits in the beverage industry closely follow the ups and downs in the national economy. The late war years and first postwar year were prosperous, and National and the other leading distillers flourished accordingly. In 1946, National hit a peak of $40-million profit on $229-million in sales.

Then a slump started. Heavy new excise taxes began to cut U.S. consumption of gin and whiskey, even though consumer incomes stayed high. The company's growth slowed, at a time when Porter was nearing retirement age. It became obvious that something would have to be done quickly to restore the company's growth, unless management was going to rely solely on the increase of U.S. population to give it a year-to-year sales boost.

New Blood, New Course

At this point, John E. Bierwirth, a director of National since 1942, was invited to become president. He was a banker, president of New York Trust Co. and second in command at Thompson-Starrett, one of the country's largest construction firms.

Bierwirth recalls that he took the job only after Porter had agreed on the wisdom of extending the company's operations further into chemicals.

As Bierwirth saw it, the whiskey business is much like the banking business: You sock away a heavy investment and let it sit, in the hope of getting a modest return on it at some future date. But it doesn't offer either a quick or a large profit.

There were a couple of growth industries where National Distillers could hope to turn its money over faster. One was oil; the other was chemicals.

But Which?

In comparison of the two industries, Bierwirth and his aides found several advantages on the side of chemicals:

Oil probably offered a greater profit margin, but chemicals required a much smaller initial investment. To get into petroleum in an integrated way, National Distillers would have to lay out hundreds of millions of dollars; to get into chemicals, tens of millions of dollars would do.

The chemical business eight years ago seemed to offer more room for growth. Chemicals' volume and profits grow faster than the economy as a whole, chiefly because research is continually developing new products.

Diversification into chemicals offers a wider choice of fields than petroleum or many other industries. It may cost $50-million to get into one line but only $2-million to get economically into another. Variation is equally wide in the amount of technical knowledge needed, ratio of working capital to fixed assets, raw materials position. To a company starting virtually from scratch, as National Distillers was, this range of choice is important.

Boost from du Pont

To clinch the decision, National Distillers was encouraged to get into chemicals by one of the giants of the industry. E. I. du Pont de Nemours & Co. was looking for another company to make metallic sodium, one of the main ingredients of tetraethyl lead.

Late in 1949, Bierwirth accepted du Pont's invitation and made the company's first big move into chemicals. National built a $9.5-million plant at Ashtabula, Ohio to make metallic sodium and chlorine through the electrolysis of sodium chloride.

The plant and process were based on patents and knowhow provided by du Pont. The Ashtabula site was chosen for proximity to a du Pont plant that was to take a stated percentage of the sodium output, also proximity to a market for the chlorine byproduct—a Hooker-Detrex plant that was going up nearby to use National's chlorine and Union Carbide & Carbon Corp.'s acetylene, also produced in the vicinity. Hooker-Detrex now produces chlorinated solvents from these materials; the source of acetylene just down the road would be equally important to National Distillers if it decided to upgrade its own chlorine.

Buying Research

The Ashtabula plant was operating by mid-1950, but Bierwirth wasn't satisfied yet. He needed a strong research staff to put his company into contention in the fast-moving chemical industry.

Early in 1951, he bought from Air Reduction Co., Inc., a 25% interest in U.S. Industrial Chemicals, Inc.; by yearend, he acquired the rest through an exchange of stock. USI brought National the nucleus of a research organization, along with a well-established sales group and an established position in industrial alcohols and derivatives.

Moreover, USI produced animal feed supplements, as National did from its distillery byproducts.

Also in 1951, Bierwirth bought a 20% interest in Intermountain Chemical Corp., which mines trona, a natural soda ash used in glass manufacturing; Food Machinery & Chemical Corp. holds the other 80% interest. In 1952, he purchased Algonquin Chemical Co., manufacturer of chlorine, caustic soda, and sulfuric acid.

The Key Deal

However, National's pivotal move in the chemicals industry was the formation of National Petro-Chemicals Corp., owned 60% by National Distillers and 40% by Panhandle Eastern Pipe Line Co.

National put up $35-million originally for this new company, based on a plant at Tuscola, Ill. to produce petrochemicals from the hydrocarbons extracted from natural gas.

Neither partner had any extensive experience in petrochemicals, so plans for the synthetic alcohol, ethyl chloride, ammonia, and polyethylene units were either obtained from contractors or by license from other companies already in the field.

Bierwirth and Hulse, his vice-president in charge of chemical operations, however, looked on National Petrochemicals—as on the other acquisitions—as simply the most expeditious means to a fast start. If National Distillers was to make the most of its move into chemicals, it would have to expand on the basis of new products and processes developed through its own research efforts. The company didn't want to depend on breaking into older fields and merely letting the market grow with the nation.

Early Emphasis

That's why National Distillers, young in the chemical industry, is spending relatively more for research and development than many of its competitors—$2-million a year for basic research, plus investment in new plants. Bierwirth and Hulse are confident that this rate of spending will pay off.

For example, chief emphasis at central research headquarters in Cincinnati has been, since the early days, on a search for new uses for metallic sodium. At Ashtabula, the company has a smooth-running plant turning out metallic sodium for sale to du Pont, for making antifreeze; to Archer-Daniels-Midland Co., for making fatty alcohols; to Electro Metallurgical Co., a division of Union Carbide, for making titanium, and a growing number of other companies.

These markets are satisfactory, but if National Distillers could find its own uses for metallic sodium, its profits could be even higher. The first result to come from the lab along this line is a sodium peroxide process that's being used at Ashtabula.

The next production units due to come from research on sodium will be National's isosebacic acid plant at Tuscola and its titanium and zirconium plants at Ashtabula. All three plants are being scaled up from pilot models at Cincinnati to full commercial production without going through the semi-commercial stage that most companies deem necessary.

Titanium

The Ashtabula units will gain six months or a year by being built within the framework of a 175,000-sq. ft. foundry bought from Lake City Malleable Co. It's geared to produce 10-million lb. of titanium and 2-million lb. of zirconium a year.

National's sodium reduction process will use metallic sodium from the company's plant less than a mile away to convert titanium tetrachloride to titanium sponge. National may get equally nearby sources for its titanium tet—New Jersey Zinc Co. has just picked up an option on a big tract of land in Ashtabula, perhaps to produce titanium tetrachloride, and Stauffer Chemical Co. also plans to build a titanium tet plant in the area.

Developers claim National's sodium reduction process produces a sponge of higher purity and at lower cost than the conventional magnesium reduction (Kroll) process. Some other titanium makers dispute this claim. They say National can't make money at the low prices it's quoting.

Glamorous and Risky

National Distillers is well aware that the fields of titanium and zirconium are risky as well as glamorous. So far, despite rave notices, titanium has found a market only where its high strength-to-weight properties are worth the relatively high cost. And the competition is tough: du Pont, Titanium Metals Corp. of America, Union Carbide's Electromet division—the cream of the chemical processing industry.

Zirconium has solid backing from the Atomic Energy Commission but has an equally uncertain future. It is costly—$12 to $14 a pound compared with, say, aluminum at 27¢—and is so far limited namely to specialized uses, as in atomic reactors and in tubing for chemical processing plants, where corrosion is a problem.

Hulse recognizes the obstacles but remains convinced that the company is on the right track. The sodium reduction process for titanium, worked out in the high-temperature lab at Cincinnati, could have other applications, too, he points out. Another process under study is the use of silica or some other inert material coated with sodium, to remove sulfur from coke-oven light oils in a fluid bed system. If perfected, this process could be invaluable to petrochemical producers who want—at almost any cost—to get the sulfur out of light oil stocks.

Brand-New Fields

While National Distillers is stressing research on new uses for the bulk materials it already makes—sodium, chlorine, caustic soda, sulfuric acid, methane, ethane, propane, etc.—it isn't resting on its present base of raw materials.

Last spring, it acquired Metalectro Corp. of Laurel, Md., a company that was in rocky financial shape, but had a toehold in the missiles business, with valuable knowhow about such things as unsymmetrical dimethyl-hydrazines—favored rocket fuels. The Maryland crew, besides working on high-energy jet fuels, is also giving special attention to chemicals, such as the aluminum alkyls, that can be used as starters for rocket engines.

And at Tuscola, the heart of the company's petrochemical activities, the fruits of research promise to lead to expansion in half a dozen new directions.

As a prelude to other developments, capacities for ethylene and other petrochemicals are scheduled for a big boost next year. Polyethylene units that went on stream in March of 1955 at a 26-million-lb. annual pace will be quadrupled in capacity by the second quarter of 1957.

They are also being modified to produce either high density or low density polyethylene.

USI's next big expansion as a National Distillers division will probably be a 50-million-lb.-a-year plant to produce polyvinyl chloride, used as an intermediate material in the plastics industry and as a refrigerant, and its copolymers.

Out of the Sands

Through USI, National Distillers has taken an option on an Australian process for extracting zirconium from beach sands. The process is being tested at Cincinnati. If it proves out commercially, National would probably buy it from the Australian Commonwealth Scientific & Research Organization with the hope of applying it not only to zirconium but to recover other minerals as well.

The process is said to cheaply turn out zirconium free of hafnium, an element normally associated closely with it. Hafnium has interesting properties of its own, but zirconium that's tainted with it can't be used in certain types of atomic reactor construction.

Atomic Radiation

National Distillers is participating in Industrial Reactor Laboratories, Inc. In the plastics field, irradiated polyethylene is already a sensational commercial product. National makes polyethylene and wants to know all about the radiation process, for both polyethylene and similar plastics.

Nuclear radiation is capable of modifying many common chemical reactions. National's researchers are also particularly interested in materials for nuclear reactors, since National makes metallic sodium, used in some types of reactors as a medium of transferring heat, and will soon be a manufacturer of zirconium, used in fuel elements.

They're looking, too, at the problem of chemically reprocessing spent fuel elements.

Changing Character

The broadening of National Distillers' research pattern is reflected in the company's over-all allocation of funds for capital spending.

Out of the $44-million fund that National is plowing into expansion in 1956-57, only $8-million goes for beverages and fermentation alcohol —the other $36-million is for chemicals and allied products.

National's investment in the chemical business is rising fast. A year ago, it had $124-million worth of fixed assets in this end of the business; already the total is up to $138-million, and it will be $160-million by the end of next year.

Within the chemical business under National's roof, the product mix is changing, too, toward the hotter and newer items.

At midyear, 13% of the company's investment in chemical plant was in sodium and its derivatives, 72% in petrochemicals, and 15% in agricultural chemicals. A year from now, the breakdown is expected to be 19% in sodium and derivatives, 70% in petrochemicals, only 11% in agricultural chemicals.

What information does a firm need in order to evaluate a growth opportunity? How good must the venture appear for a company to act upon it? These and similar questions must be answered before a firm can make a decision to engage in a new venture.

In this case, the Liggett Adhesive Corporation is presented with the opportunity to acquire the manufacturing and marketing rights to a new box sealant. The authors present a substantial amount of essential background information regarding the new adhesive. The market potential, profit and loss statements, sales and marketing plans, product evaluation data, etc. are all carefully outlined.

The material is presented in the same general form that top management ordinarily requires for analysis. Those reading the case are asked to put themselves in the position of Liggett's decision makers, and think through the advantages and disadvantages of the proposition. The authors conclude with the thought provoking question "Should Liggett Adhesive accept the proposal . . . . ?"

10 The Liggett Adhesive Corporation

by Ralph Westfall and Harper W. Boyd, Jr.

On January 21, 1959, Mr. Edward West, senior vice-president of the Liggett Adhesive Corporation, was approached by the president of the Turner Research Co., Mr. John Turner, with a proposition that Liggett enter into an agreement with Turner to manufacture and market an adhesive known as Zipdry. This adhesive, a product of Turner Research, was developed as a sealant for shipping cartons and corrugated boxes. Because of its extremely short drying time, Zipdry had been found particularly adapted for use on rapid, automatic sealing machines. In addition, the product was highly moisture and water resistant, making it useful for cold storage and packaging moist products, such as fresh produce.

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The Liggett Adhesive Corporation was a large Chicago manufacturer of a variety of adhesives for different industrial purposes. The company's volume of approximately $175 million was sold primarily in the Midwest and Southwest. The Paper Products Division of Liggett directed its activities toward the paper and pulp industries. Its chief product was an adhesive that was mixed with pulp in order to provide a binder for the paper fibers. This product was sold direct by the division's own small sales force. The division also produced and sold a limited volume of water resistant carton sealants of a lesser quality than Zipdry. Because of established marketing procedures, however, this group of products was not pushed aggressively and was handled practically as a side line.

Approximately a month after Mr. Turner's visit, Mr. West received a letter spelling out in detail the nature of the proposed venture. The letter read as follows:

February 12, 1959

Mr. Edward G. West
Senior Vice-President
Liggett Adhesive Company
4112 W. Grand Avenue
Chicago 10, Ill.

Dear Mr. West:

Pursuant to our conversation of January 21, 1959, concerning Turner Research Corporation's product, Zipdry, the following are my specific thoughts concerning the proposed relationship of Turner and Liggett in regard to exploiting this adhesive.

The Plant

We are at present leasing a 12,000 sq. ft. plant for $200 per month in Zanesville, Ohio. Additional equipment required for this plant is three 4,000-gallon storage tanks plus two pumps. This will bring the plant capacity to 300 drums of adhesive per month.

The Finished Product

Zipdry is a water resistant adhesive. Our costs and selling prices are as follows:

Sales price (F.O.B. Zanesville)		$137.50 per drum
Costs:		
Raw material	$39.04	
Nonreturn 54-gallon drum	4.75	
Cash discount (usually taken)	1.38	
Jobbing commission (30%)	41.25	
		86.42
Gross profit to overhead		$ 51.08

The attached profit and loss sheet (Exhibit 1) shows the results for Turner Research Corporation for 1958 in some detail. Since the early part of the year

Exhibit 1 Turner Research Corporation Profit and Loss Statement: January 1–December 31, 1958

Sales			$23,341.14
Cost of sales:			
Factory payroll	$ 4,900.00		
Social Security tax	110.25		
Payroll insurance	40.60		
Containers	733.94		
Raw material	11,404.19		
Supplies	30.78		
Repairs and maintenance	331.77		
Insurance	50.87		
Rent	2,150.00		
Utilities	549.08		
Royalties	1,600.00		
Taxes and licenses	224.38		
Depreciation	1,434.72		
Miscellaneous expense	38.66		
Laundry expense	108.50		
		$23,707.74	
Less—Mfg. cost to samples	348.16		
Variation in inventory	889.16		
		$ 1,237.32	
			22,470.42
Gross profit			$ 870.72
Selling and administrative expenses:			
Executive payroll	$ 8,750.00		
Selling compensation	7,325.00		
Social Security tax expense	173.25		
Payroll insurance	125.15		
Jobbing commissions	4,320.15		
Freight and express	1,653.08		
Telephone and telegraph	716.27		
Insurance	122.66		
Sales warehousing	177.74		
Sales expense accounts	5,048.38		
Samples	595.96		
Other advertising	100.94		
Office supplies	68.52		
Postage	22.45		
Taxes and licenses	258.79		
Discounts allowed	228.63		
Professional services	6,080.00		
Interest	3,030.00		
Depreciation	64.56		
Unemployment tax	193.13		
Miscellaneous expense	45.35		
			$39,100.01
Loss for period			($38,229.29)

was devoted to experimentation, production costs are greatly overrated. Some costs were also incurred on other projects that have been discontinued. It is contemplated that Turner's present sales price structure will be continued.

Market Potential

There are (according to 1953 figures from *Pulp and Paper*) over 15,000,000 gallons of water resistant adhesives and over 30,000,000 gallons of general adhesives sold per year. Zipdry is unique in that it can be used in applications where non-water-resistant adhesives are now used, but for purposes of this letter we will consider only the market for water-resistant adhesives. The following list of states, with their shares of the total United States market is based on the number of box manufacturing plant employees, which is not precisely accurate but gives a general view of the markets.

1. Ohio	11.64%	7. Indiana	5.25%
2. Michigan	11.50	8. New Jersey	4.77
3. Pennsylvania	10.97	9. Connecticut	4.33
4. New York	10.33	10. Massachusetts	4.24
5. Illinois	9.23	11. Wisconsin	3.18
6. California	6.48		

In my opinion, the natural and long-range disposition of the foregoing markets would be as follows:

Chicago, Ill., plant, supplying the markets of:

Illinois	9.23%
Michigan	11.50
Indiana	5.25
Wisconsin	3.18
	29.16%

Zanesville, O., plant, supplying the markets of:

Ohio	11.64%
Pennsylvania	10.97

New York City plant, supplying the markets of:

New York	10.33%
New Jersey	4.77
Connecticut	4.33
Massachusetts	4.24
	23.67%

Los Angeles plant, supplying the market of:

California	6.48%

At the present time Zipdry is being sold in only two market areas, Cleveland and Los Angeles. The following is a list of accounts which either are now testing Zipdry or are customers or have been customers, as indicated:

Cleveland

Horner Packing Co.
Inland Canneries
Ohio Produce Co.
Kraft
Cleveland Mfg. Co.
General Box Co.

Los Angeles

Sunkist
Valley Produce Co.
Citrus Growers Assn.
San Fernando Co-op
Export Packing, Inc.
15 other smaller packers and manufacturers

In addition to the foregoing accounts, we are selling on a house account basis West Virginia Tobacco Company, Wheeling, W. Va., and American Canneries, Inc., Fort Wayne, Ind. Also we have had as customers many fine firms, such as Wellington Packing Co., Harrison, N.J.; Johnson Co., Cleveland, O.; Cooper & Co., Philadelphia, Pa.; and National Manufacturers Co., Newark, N.J.; which we have lost as a result of product instability.

Proposed Sales Organization

The plan of attack which I propose is simply this:

1. All customers presently using your own box sealants to be switched to Zipdry. I think it reasonable to assume that 75 per cent of the accounts could be switched, using only the present Liggett personnel assisted by our Mr. Miller. This would give you a fairly immediate sales volume of eighteen drums per month.
2. Carefully evaluate the large volume users in the Illinois market with a view to determining which accounts your present personnel in Chicago think they could sell with some specialized assistance. These accounts should be set up on a "house account" basis. Depending on the number of these accounts, sufficient manpower should be hired and trained by Mr. Miller to work with present Liggett salesmen. There should be one man for each fifteen or twenty accounts.
3. The finest manufacturers' representative available in Illinois should be induced to handle Zipdry to cover the remainder of the accounts in that state. Trained Liggett specialists should be assigned to assist him. Since we pay a relatively high commission (30 per cent), a plan should be introduced to have the manufacturers' representative hire one or more specialists to push the sale of Zipdry. These men would be trained by Liggett. Their salary and expenses would be paid by Liggett until such time as the manufacturers' representative had reached a previously agreed upon sales volume, then he would assume the specialists' overhead.

Joint-Venture Agreement

It is my suggestion that Liggett and Turner enter into a joint-venture agreement providing for the following:

1. Capital Contributions:

a) Turner would contribute all its manufacturing equipment, its leasehold on the plant, and the formula. In addition, Turner would sell its inventories and receivables to the joint venture for an amount in cash equal to the book value as of May 31, approximately $7,500.

b) Liggett would contribute initially $7,500 in cash to the joint venture to permit purchase of Turner's receivables and inventory. In addition, Liggett would contribute sufficient cash to purchase equipment previously mentioned for the Zanesville plant and $3,000 per month plus such additional funds as would defray travel expenses and the purchase of raw materials and containers as may be required. Additional cash may be required to bring base inventories up to an optimum amount. As soon as the monthly profits have reached sufficient levels, there would no longer be need for Liggett to make monthly con-

operating expenses would be paid out of profits.

2. Division of Net Profits:

The net profits of the joint venture would be shared equally by Liggett and Turner, provided that Turner would be indemnified against any losses incurred in the venture. Liggett would be entitled to recoup such loss incurred by reason of such indemnity out of Turner's share of future profits.

In the determination of net profits, all sales of Zipdry would be credited to the net profit account of the joint venture, as would be all costs of operations, including monthly operating costs of Turner. The venture's overhead costs, including sales organization expense of Liggett incurred for the joint venture and a fair charge for over-all supervision and accounting, would be charged to this account. No distribution of profits would be made until the venture was in a position to operate with its own funds, and thereafter distributions of profits would never reduce the available cash below a minimum required for normal operations. Turner would receive a $2,350 a month management fee (included with the $3,000 operating requirement) to compensate it for the cost and expense of furnishing the services of its personnel.

3. Option by Liggett to Purchase All Turner's Outstanding Stock:

Turner would cause its shareholders to give an option to Liggett to purchase all Turner stock at a price of $702,000, the option to be exercisable at any time during the term of the joint venture. In the event that sales of the joint venture reached 750 barrels per month, Liggett would be obligated to purchase such stock.

If this letter sets forth your understanding of the points discussed in our conference of January 21, 1959, I suggest that the next step would be for your legal department to prepare the first draft of the joint venture agreement.

Sincerely,
(*s*) J. Turner
John Turner

This proposal was turned over to Mr. J. C. Williams of Liggett's market research division for analysis. He was asked to develop data to (1) evaluate the market potential for Zipdry, (2) determine the more important considerations involved in expanding the sales of Zipdry, and (3) determine attitudes of previous Zipdry customers to a re-introduction of the product.

After a period of several weeks, during which time Mr. Williams reviewed company records and trade publications and conducted a number of personal interviews with purchasers of box adhesives, the following data were accumulated:

The Market

During 1957 Liggett sold approximately 21,000 gallons of water resistant box sealant. Of this total approximately 500 gallons was of the rapidly drying type that could be used upon fast machines. The remainder was of a low-priced type used for slower and hand-fed machines. The total market for box sealants was as shown in the accompanying tabulation.

Total Market for Box Sealants

U.S. consumption of all types of box sealants	60–80 million gals.*
U.S. consumption of water resistant sealants	18–28 " " *
U.S. consumption of high-priced, water resistant, fast-drying sealants	4.3–6.7 " " *
Consumption of high-priced, water resistant, fast-drying sealants in Liggett's market area	1.7–2.7 " " *
Number of plants using box machines in U.S.	21,518†
Number of plants using box machines in Liggett's market area	8,845†
Number of employees in plants using box machines	6,139,123†
Number of employees in plants using box machines in Liggett's market area	3,186,102†

*Data for 1957.
†Data for 1953.

The market for water resistant adhesives for box manufacture is growing substantially. This growth is coming from both a greater use of boxes in the economy and an increasing market share of the total sealant market. Water resistant adhesives accounted for approximately 27 per cent of all sealants sold in 1953. This is reported to have increased to 35 per cent in 1957. The trend toward greater use of water resistant adhesives is being caused by their generally cheaper price and ability to form a faster and better bond.

Buying Habits and Motives

Most adhesives for sealing machines are purchased in 55-gallon drums, some in 5-gallon cans. Very large users, such as Campbell's Soup, buy in truck-load lots of 60 drums, while small users order a drum at a time as the need arises.

Almost every user said that "next-day" delivery was available, but most users order two to three days in advance.

A 1953 study indicated that 74 per cent of adhesive purchasers bought through local distributors, 26 per cent purchased direct from the factory, 23 per cent bought from a manufacturers' agent, and 18 per cent from a manufacturer's salesman. (The figures add to more than 100 per cent because of multiple sources of supply.)

Most users have more than one supplier of adhesives, the number running up to five or six with larger users. Only one company interviewed had changed any of its suppliers in the last twelve months, and this was because a comparable product was obtained at a cheaper price. Other users interviewed had long-standing relationships with their present suppliers.

Acceptance of a new product by a user generally requires a number of tests, which sometimes take from three to six months. The testing of a new product may slow down or even stop a packing line. For this reason, products must have promise of great advantages before many plants will test them.

In small plants strong personal relationships often exist between suppliers' salesmen and shop personnel. This tends to make them resist new products.

Although purchasing agents have been deluged with adhesive salesmen, most are looking for new products that can cut costs and otherwise improve output. It appears that a product bearing a major brand name would stand a much better chance of being accepted for test than would an unknown independent brand.

The factors that purchasing agents reported to be most important in selecting an adhesive were, in order of importance, as follows: (1) quality of the bond made by the adhesive, (2) freedom from spoilage, (3) ease of cleaning the machine, (4) allowable speed and feed rates, (5) customer service, (6) freedom from harmful ingredients.

Competition

The box sealant market is characterized by a large number of suppliers. These include both large and small firms. The ease with which an individual can enter the field has caused the market to become overcrowded since World War II. Purchasing agents stated that they have as many as six box sealant salesmen a week calling on them, each claiming that his product will lower costs, increase production, etc.

Some suppliers have become firmly established in the market by specializing in offering a full line of sealants and related products and by applying heavy sales and promotional effort to the larger users. The smaller and less well-known suppliers often depend upon extravagant claims for their products in order to have them tested by a prospective customer.

All suppliers offer technical service to their customers both on an "on-call" emergency basis and on a periodic visit basis. The technical ability of many of the smaller companies' representatives was questioned by some of the purchasing agents, emphasizing the need for qualified box machine technicians to sell and service this type of product. Suppliers also offered to furnish specially compounded sealants for different kinds of box problems.

Product Quality

A sample of the adhesives for box sealing in the Chicago area revealed the information shown in the accompanying tabulation.

Tests conducted by the technicians on the Liggett staff revealed that under high-speed conditions Zipdry showed definite advantages over Liggett's existing quality product. These advantages became evident, however, only under high-speed conditions, indicating that the product would find its best market among those plants producing a large volume of boxes.

		*Coverage**		
Supplier	*Product*	*Recommended*	*Actual*	*Price per Gal.*
	In Chicago Area			
Miller Glue Co.	T-140†	5,000	2,500	N.A.
Chicago Adhesives	Sealall	1,250	N.A.	N.A.
	#30†	3,750	3,750	$1.02
Cleveland Corp.	Cimglue†	N.A.	N.A.	$1.90–$2.00
Highwood Chemical	Trim†	2,500	3,750	$2.50
Animal Products	#1502	N.A.	2,500	$ .50
Standard Adhesives	Superla	N.A.	2,500	$ .50
Sun Company	N.A.	N.A.	1,800	$ .45
Johnson Products	Loseal†	N.A.	9,000	$3.50
Western Glue	#8LA†	N.A.	1,800	$1.55
	In Eastern Plants That Were Formerly Turner Accounts			
Penn Products	Mikro Seal†	N.A.	1,800	$1.46
Animal Products	#1421†	N.A.	2,500	$ .55
Elm Chemical	N.A.	N.A.	5,000	$2.50
Miller Glue	T-200	N.A.	N.A.	$1.90

*Number of linear feet of coverage by a six-inch-wide double strip.
†Fast-drying, water resistant sealant.

Companies interviewed which had used Zipdry reported as follows:

Wellington Packing Co., Harrison, N.J.: Wellington used Zipdry from August of 1956 through the spring of 1958 with good results, and the central purchasing department had recommended it for all plants. They stopped buying Zipdry because of the tactics of the Turner sales representative, now no longer with the company, who apparently worked through plant personnel rather than the purchasing department. They would consider using Zipdry again if evidence could be presented that the spoilage problem had been completely solved.

Johnson Co., Cleveland, O.: The purchasing department records showed no reference to Zipdry, and the purchasing personnel had no recollection of ever having used Zipdry. They would not be interested in any product the price of which was not comparable to that of their present supplier, $0.55 per gallon.

Cooper & Co., Philadelphia and Harrisburg, Pa.: Personnel at the Philadelphia plant had no recollection of using Zipdry. The purchasing agent at Harrisburg remembered placing a small order for Zipdry in 1956, but had not reordered. They found nothing outstanding about the product.

National Manufacturers Co., Newark, N.J.: They are still using some Zipdry left on hand but do not plan to reorder. They have found what they consider to be a comparable adhesive at a lower price.

Wilson Mfg. Co., Pittsburgh, Pa.: The Wilson Manufacturing Company's tests of Zipdry rated the product 84.7 per cent on their quality scale. They claimed that there were other products available that rated 116 per cent to 117 per cent on this scale and that sold for less than $2.50 per gallon. Penn Products' "Mikro-Seal" rated 90 per cent and sold for $1.46 per gallon.

Two tests run in Chicago brought diverse results as to Zipdry's quality. Fearn Products found that Zipdry did a superior sealing job and got roughly eight times the coverage as compared to the adhesive they were using.

Harper Company, on the other hand, had a serious problem with spoilage in a short time. Harper is a smaller company and their sealing machine operates only intermittently.

Should Liggett Adhesive Corporation accept the proposal of the Turner Research Company?

In recent years, a great deal of emphasis has been placed upon investigating the problems involved in the introduction of new products. However, very little attention has been paid to the concomitant problems of eliminating products from the product line. The chemical industry, because of its high rate of product introduction, has a correspondingly great interest in seeing that products are successfully abandoned.

Successful product deletions are essential to the growth of the business enterprise. If a product is not pruned from the line when it should be, then the money, facilities, manpower, etc. tied up in the abandonment candidate can successfully depress the overall profit outlook of the firm, and provide an effective barrier to the introduction of other, more profitable, products.

These deleted products, however, can still provide a sound basis for the growth of an enterprise—but this must be *another* enterprise, one which has a different cost structure. For, a product which might not have a sales volume sufficient to provide a suitable return for Company A might very well be excellent for Company B (which would ordinarily be a smaller firm).

In the case below, some of the factors surrounding the concept of growth via product elimination are delineated—both the growth of the enterprise doing the product pruning and the growth of the firm considering the acquisition of the pruned chemical products.

11 Clinton Chemicals, Inc.: Acquisition of Products Discontinued by Other Companies

by Roger Allen

In March 1959, Clinton Chemicals, Inc., was considering whether or not to add to the company's lines the manufacture of the two new series of products. It had been a policy of Clinton Chemicals since its formation to be on the lookout for products cast off by larger companies in

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the industry. Mr. Mark Monroe, president of Clinton, thought that the products under consideration might offer the same opportunity that had been afforded by previous product line discontinuations by large companies. The experience of Clinton Chemicals over the last ten years seemed to him to be convincing evidence that a small company, with its inherent natural advantages, could do an outstanding job with product lines in which larger companies no longer had an interest.

The first product to draw the Clinton company's attention was an adhesive suitable for special coating purposes. This special-purpose adhesive had been on the market for ten years, and the polymers, or resins, upon which its manufacture was based had been known for almost twenty years. Only the McSwann Chemical Company, a large chemical producer, however, had endeavored to manufacture the adhesive commercially. Mr. Monroe had been advised, through friends in the chemical business, that McSwann intended to discontinue offering the special-purpose adhesive for sale in approximately six months.

A second product under consideration was in the solid rubber field. This product had unique and outstanding qualities of resistance to abrasion and high temperatures. Early inquiries indicated that individual orders tended to be small but that the over-all market was fairly substantial. Up to this time, the Cleaver Chemical Company, the third largest company in the industry, had been the sole producer of the special solid rubber product.

Clinton Chemicals had been organized in 1948 as an affiliate of the Charlotte Chemical Company of Rochester, New York. Charlotte Chemical was a long-established producer of resin finishes for the paper industry. It was a relatively small company with a capitalization of less than $500,000. It desired to establish an affiliate company that would allow greater diversification through customer and market augmentation. The decision was made to set up Clinton as a separate corporation, rather than as a division, to be operated autonomously in order to take advantage of the flexibility of a small company and to obtain the driving force of independent management. The products of the new company were to be primarily polymers, or latices based on butadiene, vinyl acetate, and styrene. In addition to providing products suitable for the paper industry, Clinton planned to manufacture resins for sizing operations in textile processing and basic materials for the adhesive field.

Mr. Mark Monroe, a chemical engineer with extensive research and development experience in large chemical companies, accepted the offer to become president of Clinton. As a result of his own experience in working for several large companies, he was aware of the research, marketing, and other specialized resources available to those organizations. He felt certain, however, that the advantages of large-scale enterprises were far from insurmountable. "Politicians and editorial writers," in Mr. Monroe's opinion, "include small businessmen in their idealized characterizations of the American way of life, along with the farmer, the newsboy, and the American mother. The facts of the matter are that we in small business have to compete with big business purely on merit with no quarter asked and no quarter given."

Sales in the first year had been about $200,000 and remained level for the next three or four years of the company's existence. By the end of 1958, sales had increased to over $2,000,000. While sales were on a nationwide basis, they were concentrated in the Midwest and the eastern part of the United States. In 1958, Mr. Monroe estimated that there were about 400 regular customers who were serviced primarily by manufacturers' agents. The company had its own sales office in New York City and supplied "missionary" aid to all of its "reps" from the home office. Mr. Monroe said, "We try to have someone from the home office visit each representative every six weeks and spend one week with him making his calls. I'm afraid this has been more of an ideal than a reality, but we try to be sure that no more than 12 weeks go by without a visit from the home office." Mr. Monroe felt that these visits were extremely important to the success of the company because, "This was the best way of introducing the representatives to the latest company developments."

By 1958, Clinton had over 30 employees at its plant in Rochester, almost one-third of whom were trained technical personnel engaged in research. The production organization had a great deal of flexibility because of an arrangement with Charlotte Chemical Company whereby space and personnel could be "leased" on whatever basis required. Clinton owned all of its equipment and, in some instances, had purchased and stored equipment in anticipation of a wider product line. By 1958 the product line had developed to the point where there were over 500 separate products avaliable. Only about 20 of these products, however, accounted for 80% of total sales volume.

Product Policy

About three-fourths of Clinton's volume was accounted for by products which it had developed itself. For example, Clinton introduced one of the first specialty polymer products used in quick-set metal and rubber adhesives. It also introduced special coatings for use in the food packaging industry. Even if the potential market was such that there could be no question about the eventual entry of large competitors into the market, Mr. Monroe felt that his company could compete successfully, provided only that they "got there first." An example of such a situation was a chemical emulsion designed as an ingredient in the manufacture of crease resistant finishes for textiles. In spite of the entry of three of Clinton's largest competitors into the field, early sales position and the combination of manufacturing and technical service know-how had enabled Clinton to compete successfully.

Clinton also based its product policy, in part, upon its ability to produce and distribute profitably products which had been developed by large companies, some of which were competitors. When these products proved unprofitable for the large companies, because of low volume or for other reasons, they were discontinued. In this secondary area, Clinton searched for products suitable to its production and marketing facilities.

In some instances, large companies were very much interested in making arrangements with Clinton for the continuation of the manufacture of certain products, particularly when they were the sole or dominant suppliers. The need for a continued supply was important to customer relations since, in some instances, replacement of the original supplier would involve considerable expense and inconvenience to the customer. In other situations, the original producer would remain as a major source of raw materials to Clinton, thus retaining up to possibly 50% of its former sales volume. The combination of these two circumstances, a need on the part of a large company to continue an assured source of supply to established customers and a willingness to furnish basic raw materials, seemed particularly fruitful to Clinton when it was negotiating with a large company about a product which the latter contemplated discontinuing.

Bases for Product Selection

Clinton was always very greatly interested in a product that might gain the company entry into a new and desirable market which it had not previously penetrated. The printing ink industry was an example of the kind of industry the company was interested in entering. The printing industry was centered in the company's "natural" marketing area. It was a stable industry and utilized chemical products in large volume. Clinton officials felt that the company had the right kind of equipment and, even more important, the "know-how" to produce certain products for the printing industry. Most of Clinton's sales representatives were substantially involved in the printing ink field. Mr. Monroe felt that a line of related products could be developed on the basis of one successful product. With a successful product, company contacts with purchasers could be capitalized upon. Finally, the product had to promise a pattern of growth suitable to Clinton's size and future.

Mr. Monroe believed that almost all companies, large or small, had continually to add new products and discontinue old ones which had failed to achieve profit expectations. He was particularly interested in those products which had achieved a stable market position with a volume which would be satisfactory for his own company but well below the requirements of a large company. "In many instances," he said, "products seem to reach a plateau; and no matter how strenuous the efforts of the company, satisfactory volume, for them, cannot be achieved. One of the most interesting aspects of this kind of situation is the internal struggle that goes on in the big company when we approach them with the idea of replacing them as a manufacturer on the basis of their own interests as well as in the interests of their customers. Sometimes an autonomous organization structure of a big business works for us—sometimes against us. Sometimes we find the manufacturing department 100% for us and the sales department equally set against us. Manufacturing may want to get rid of a product on the grounds that it's just a nuisance to produce and costs much more to make than can be gained in revenue. The sales department usually likes to hold onto all the income items it can, but occasionally this department, too, is in favor of discarding a product. This seems to happen when sales has the responsibility for engineering service. If we've sized up the situation correctly, we can depend on the cost control department being on our side."

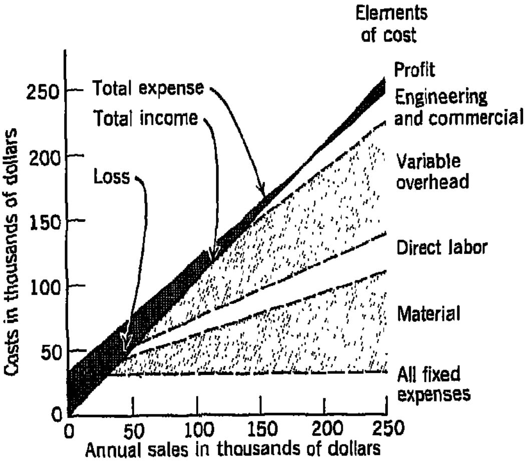
Example of a Discontinued Product Added to the Clinton Line

One of the very large companies in the chemical industry, the McSwann Chemical Company, had manufactured a solid resin for several years. While the product had other potential applications, it had gained almost all its use in the sizing of synthetic textiles. The purpose of sizing is to protect the fiber during the weaving of the yarn. By preventing breakage, sizing of the material prevents a substantial amount of machine downtime. Many substances have been used over the years, e.g., starch, gelatine, gum arabic, as well as various types of resins. In this particular situation, McSwann manufactured a competitive product which it deemed superior on an over-all basis.

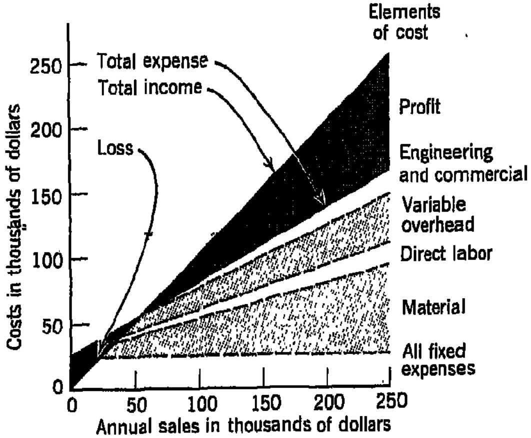
The solid resin product had attained a volume of between $100,000 and $150,000 per year. Mr. Monroe estimated that a product with $100,-

Exhibit 1. ***Breakeven charts for manufacture of specialty semifabricated product in large and small companies*** (Source: Charles H. Kline, "The Strategy of Product Policy," *Harvard Business Review*, 33, No. 4 (July-August, 1955).

Case A. Actual results in large corporation



Case B. Estimated results in small independent operation



000 gross sales would be quite satisfactory to his company as a specialty, whereas, the same product might require, as a minimum, a volume of over $200,000 if it were part of a large competitor's product line. As an example of his thinking, he cited an article by Mr. Charles H. Kline that had appeared in the July-August, 1955, *Harvard Business Review*, entitled "The Strategy of Product Policy." Two breakeven charts from that article (see Exhibit I) showed different volumes of a specialty semi-fabricated product required to break even by a large and a small company. In this example, the large company needed a sales volume of $216,000 while the small company could make money anywhere above its breakeven point of $55,000. The small company would net $72,000 on a before-tax basis if it achieved the $216,000 breakeven volume required by the large company. Although Mr. Kline's example relied upon estimated results in the small corporation, in Mr. Monroe's opinion, it closely paralleled Clinton Chemicals' experience.

In this particular case, the McSwann Chemical Company would not be leaving a vacuum in the market since there were other producers of similar solid resins. But direct replacement was never a simple process since careful testing and checking in laboratory and plant were always necessary. Even with the co-operation of the original supplier, a considerable sales effort was still required to persuade customers of the suitability, or even preferability, of the resin in colloidal solution form since Clinton was interested only in producing a resin in colloidal suspension instead of a solid, although for purposes of use the products were identical. Clinton persuaded McSwann to provide it with an introduction to some of the current users of solid resin. In exchange for information on actual customers and an estimate of the total market available, Clinton assured McSwann that it would purchase from the large company a substantial portion of the raw material required. "It has worked out very well for us," said Mr. Monroe. "We moved in when a competitor dropped out and met customers at a favored time when they were most willing to listen. There were no royalties or other problems involved. We have attained a satisfactory and stable volume with a high margin. You might say it's been almost the ideal situation."

The Product under Consideration in the Adhesive Field

According to Mr. Monroe, the decision regarding the addition of the product (described on page 153) used in the adhesive field for special coating purposes "was still up in the air." He was more interested in this product than those usually investigated because it had very intriguing physical and chemical properties. "The best way to describe it," he said, "is that the product has extraordinary stickiness, with outstanding application possibilities where such characteristics are required. I can see not one but a whole series of applications although each might be small in volume. It fits very well price-wise into our line, too, selling at about 50 cents a pound, a price fairly close to standard chemical commodity products of this type."

Mr. Monroe was very sure of a market potential of about $250,000 per year. His large competitor had not been able to achieve more than $100,000 per year in spite of strenuous, although sporadic, marketing efforts. Nor had the large competitor been able to overcome certain difficulties in manufacturing the product and giving the right kind of customer service.

"We're not worried about the market potential," said Mr. Monroe. "We may not carry out formal marketing research projects, but we conduct practical market investigations. This means talking to people in the business whom we know, and their information has turned out to be highly reliable." Mr. Monroe foresaw no special difficulties in producing the product although it would require some development that was essentially upgrading in nature. In the words of Mr. Monroe, "Our people have the know-how."

There were, however, two major problems that concerned officials of Clinton Chemicals, Inc. First, was the question of raw material supply. The sole domestic source was provided by the same large company that had been supplying the finished product. The McSwann Company was considering a discontinuation, not only of the finished product but also of the raw material. Foreign sources of supply had been investigated but were not considered dependable from the standpoint of price, quality, or availability. Clinton officials were doubtful that their production would be sufficient to interest the McSwann Chemical Company in remaining as a supplier of one basic raw material.

A further difficulty involved the amount of investment required. Originally, Clinton contemplated that additional equipment would require an investment of $50,000. Since the product would have a gross margin of 20% to 25% and the equipment was quite versatile, this amount of investment was considered satisfactory. Closer investigation, however, revealed that the total investment would be closer to $100,000. Furthermore, some of the equipment required in the second $50,000 of investment was a special type of doubtful suitability for Clinton's existing location. "It's on our schedule to move to a new location," said Mr. Monroe, "but the timetable for the move hasn't jelled yet."

The Product under Consideration in the Solid Rubber Field

A second product under consideration was a high-temperature resistant rubber compound composed of some unusual polymers. This product had been produced for almost 10 years by the Cleaver Chemical Company, a leading industrial chemical firm, and sales volume had apparently stabilized at the $100,000 level, distributed about equally among six customers. This volume was considerably less than Cleaver's minimum requirement, so that it had been decided to discontinue the product and customers had been given the customary six months' termination notice.

Clinton Chemicals became aware of the planned termination, and Mr. Monroe believed that the product was worthy of Clinton's immediate attention. He contacted the Cleaver company and some of the important customers and was able to get a great deal of information from them regarding the product. He found that both the original producer and the customers desired that a substitute source of the product be made available. The Cleaver company, however, wanted a royalty of 10% of net sales, with a $10,000 a year minimum, to release its patents and to supply its store of technical data regarding the product.

The customers indicated their intent to continue purchasing the compound at about the current volume, but also admitted some dissatisfaction with the existing product. Some of these firms informed Mr. Monroe that they had attempted to substitute other compounds, but that the substitutes had not been satisfactory. Mr. Monroe concluded that current volume would be maintained for at least five or six years.

The six customers were not currently serviced by Clinton's marketing organization and, because of their location, could not be serviced by the company's manufacturers' agents. The nature of the use of the compound necessitated that it be ordered in small, nonstandard quantities. Also, the characteristics of the compound were such that a shipment might meet specifications when shipped but be useless to the customer when received, because of decomposition during shipment. The only solution found to date had been to make prompt adjustments and reshipments to prevent creating a bottleneck in the customer's operations. Since it was apparent that the marketing function for this product would have to be performed by Clinton's home office group, service and adjustments would have to be made by them as well. Mr. Monroe knew that this service requirement would present a problem of some magnitude, since the home office was not organized to handle these matters. Also, the continued growth of Clinton's sales was already making great demands on the home office sales group.

Clinton Chemicals had never produced this specific compound, but had had very extensive experience with similar products. Furthermore, a considerable quantity of technical information on this product was available in various publications. Mr. Monroe, therefore, felt sure that his firm could produce this compound with no unusual difficulty. Consultation with the production manager confirmed this belief although investigation did reveal that additional production and testing equipment would be required. The equipment would cost about $15,000 and would be only moderately adaptable to other processes when not used for the rubber compound.

The production department provided Mr. Monroe with probable cost data which indicated that the product would yield a gross margin of 20% to 25% of net billed sales, before royalty charges. This range of gross margin was characteristic of most of Clinton's product line.

Clinton had never taken on a product which required a royalty payment; it had, in fact, rejected several products because the royalty demands threatened to reduce the profit margin below 10%. Also, some executives in the company felt that paying a royalty might set a precedent which would be difficult to break although other executives regarded royalty payments as simply another element of cost. Mr. Monroe believed that Cleaver Chemical would be willing to negotiate the royalty arrangement. It was his feeling that Cleaver would be agreeable to accepting a somewhat lower royalty percentage and minimum. He also felt that a decision regarding the two product lines would have to be made very soon or the opportunity offered might be irretrievably lost.

The increasing importance of international trade and investment to the entire United States economy has not been without major effect in the chemical industry. In 1961, exports of chemicals from the U.S. amounted to 1.7 billion dollars, representing more than 6 per cent of total CPI sales (for chemicals and allied products). In addition, 1961 was typical of recent years in that a number of domestic CPI firms made substantial investments in extra-territorial production facilities, or prepared to do so.

The reasons for this burgeoning of international activity are many. To a certain extent this international activity is merely due to a relative shortage of growth opportunities on the domestic market; thus, the chemical industry's overcapacity and price competition, together with a low rate of overall national economic growth, is herein reflected. In addition, the growth of nationalism in other nations (which demands both domestic facilities and local management and investment participation) plus the formation of international preferred trade alliances such as the European Common Market and the Latin American Free Trade Association also make it necessary for U.S. chemical firms to have overseas facilities.

The consequence of these factors is that for some time now the path to the growth of the U.S. chemical enterprise has led to international operations. It is no longer unusual to see such domestic giants as Dow Chemical or Monsanto Chemical obtain more than 10 per cent of their total sales from international enterprise. When the United States reaches a sound trade agreement with the European Common Market, and when the latter market area assumes more of the characteristics of a mass market, then the CPI's international operations should grow substantially beyond their present peak.

The necessity of developing international business has neither gone unnoticed nor been unsatisfied by the U.S. chemical industry. In the selection that follows, a good overview of some of the international activities of a number of U.S. firms, especially Monsanto, is briefly outlined.

12 Hot Race for Overseas Profits

from Business Week

Normally, the big American chemical companies are pretty closed-mouthed about their overseas activities. But one of them, Monsanto Chemical Co., has found its tongue. Several of its top executives have loosened up and given a comprehensive picture of the company's world-wide manufacturing operations and described how the expansion abroad during the past five years has boosted its foreign sales. The details were first presented last week by one of the company's vice-presidents before a meeting of the Financial Analysts of Philadelphia, and then repeated this week by Chmn. Edgar M. Queeny for Monsanto stockholders.

Out Front

Monsanto has an interesting story to tell—one that shows the company's initiative in the expanding field of overseas operations. In the postwar migration of U.S. capital abroad, Monsanto can match its record favorably with that of all but a few American companies. In its own industry, Monsanto seems to have the edge right now. And the chemical industry is no slouch when it comes to foreign ventures. It has a total investment of around $500-million in foreign plants (excluding pharmaceutical facilities), giving it a ranking of fifth or sixth in industry investments abroad.

Since 1953, when Queeny set up an international division to handle Monsanto's exports and production abroad, the company's overseas assets have risen sharply. In the same five-year period, the combined total of exports and sales from foreign operations has grown from $64-million a year to $140-million. Foreign sales now represent 20% of the company's total sales, and the biggest slice comes from the overseas operations, not exports. Although Monsanto doesn't publish a breakdown between the two, it's estimated that sales from the foreign operations in 1958 were not far under $100-million, with exports totaling $40-million plus. By comparison, exports still represent the biggest part of du Pont's foreign business—about $144-million in 1958.

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Official Conservatism

Despite the company's success in establishing itself abroad, Queeny talked rather conservatively about the company's achievements and aspirations. "As the world moves into the 1960s," he told stockholders, "we shall attempt to be prepared for the rapid changes inherent in its flux." On profits, Queeny was equally as cautious: "When startup and marketing problems are solved, we anticipate that our foreign operations will be at least as profitable as our domestic operations."

But Queeny and Monsanto President Charles Allen Thomas wouldn't be talking at all unless they were pretty confident about Monsanto's position abroad. This confidence is shared by Marshall Young, who heads the company's International Div.

Hot Race

One reason Monsanto is pushing overseas expansion so hard undoubtedly is the rising competition it faces from other U.S. chemical companies in the field of overseas production.

Du Pont, whose foreign production until recently was confined to Canada and Latin America, now is building three plants on the other side of the Atlantic—Neoprene in Northern Ireland, paint in Belgium, and Orlon in the Netherlands. Union Carbide has just announced plans to establish in Belgium its third European polyethylene plant, and in Italy its second European ethylene oxide plant. Even Allied Chemical, the slowest starter among the big chemical companies to move into foreign production, has begun to get busy. Last year, Allied established its first foreign plant in Cuba, and is at work on another in Mexico. It also is planning production facilities in Europe.

There are at least a dozen more U.S. companies that are breathing down Monsanto's neck. Olin-Mathieson, American Cyanamid, and Dow are pushing aggressively into foreign operations. And General Aniline is waiting to make a move. By buying into an existing chemical company, Olin-Mathieson has got a foothold in West Germany, where opportunities for investment in chemicals are few.

By now, most of the big and medium-size American companies have established international divisions that control both exports and overseas production—although it was only last year that du Pont and Dow made this shift. A number of companies have established European headquarters for sales or financial operations, or both, in Switzerland. Most have research laboratories across the Atlantic.

Varying Methods . . .

In their migration abroad, U.S. chemical companies aren't using the same methods of operation. Du Pont, like General Motors in the auto industry, is establishing wholly owned subsidiaries. Cyanamid apparently intends to hold at least a majority interest in any of its foreign production facilities. But most of the other companies have gone, or plan to go, into joint enterprises, often with a minority interest. Some of these companies argue that a partnership with a local chemical producer lessens the risk in the event of bad times.

. . . and Motives

U.S. companies differ, too, in their reasons for rushing into an area like the European Economic Community. Some of them have their eyes primarily on the growing sales potential in the Common Market and the fact that member countries will be reducing tariffs among themselves and raising them against outside nations to keep exports out. Monsanto, for example, cites that with the rising production and consumption curves in Western Europe and the development there of an American-type mass market, it provides new demand for most of the end products of the U.S. chemical industry.

The head of one U.S. chemical company looks at Europe somewhat differently. He flatly says that European plants are going to grab the world's export business, that chemical sales from this country will be a mere dribble in 10 or 15 years. This executive maintains that his company must have production facilities in Europe just to hold onto its present $15-million in over-all foreign sales. Another company, whose export business has been concentrated in Latin America, seems primarily interested in Europe as a production base to serve this market and only secondarily to meet the rising demand in Europe.

Cost Advantages

There are some real cost advantages in supplying third markets from a European plant. Although the disparity in labor costs isn't as great in the chemical industry as in some others, wages in Western Europe nonetheless average about one-fourth of the American level. Also, plant costs usually run approximately between 80% and 90% of what they do in the United States.

Of course, there's a limit to how far the American chemical companies can profitably exploit investments in Western Europe. The Europeans have an industry that's a match technologically for the U.S. in most chemical products.

Superior Knowledge

For the present, though, U.S. companies have the advantage of surplus capital—they are flush with cash right now and there is no shortage of domestic capacity. What's more, for some products—like ethylene oxide and polyethylene—U.S. companies have a real advantage in know-how.

Over the past five years, Monsanto has been capitalizing on its superior knowledge for certain products in areas where growth in local demand has been impressive. Since 1953, for example, polystyrene consumption has increased 175% in France and 233% in Argentina. Monsanto has manufacturing facilities in both countries. Demand for dodecyl benzene has risen 289% in Italy, and Monsanto's Italian affiliate has grabbed a good share of the market for this product, which is important in detergent manufacture.

Stronghold

Monsanto is especially strong today in what the company calls its "United Kingdom-Europe consolidation." Some 70% of its overseas assets are concentrated in this area, from which the company derives between 50% and 60% of its foreign sales. As recent investments pay off, the area should produce an even larger proportion of sales.

The company's largest and oldest (1920) subsidiary abroad is Monsanto Chemical, Ltd., of Britain, which now has annual sales of close to $50-million. The parent company owns two-thirds of this firm, and the rest of the equity is held publicly. Compared to Imperial Chemical Industries (annual sales run close to $1-billion), Monsanto, Ltd., doesn't look too impressive. But Monsanto's British subsidiary ranks next to ICI in the British chemical industry and stands well ahead of any other American-owned chemical company in Britain.

To boost sales in the Common Market, Monsanto is counting on a partnership (dating from 1951) with Societe Edison of Milan. Monsanto now has a 40% interest in this joint company, Sicedison, and it has invested fairly heavily in the expansion of petrochemical facilities in the Po

Valley. (Through its partnership with Monsanto, and another one with Union Carbide, Edison now ranks second to Montecatini in the Italian chemical industry.)

The Planners

In planning its overseas investment, Monsanto relies in part on an "overseas development group" within the International Div. This group, made up of chemical specialists rather than economists, works under the wing of Marshall Young. A vice-president, Young now devotes most of his time to overseas investment problems. This year the company has earmarked $12-million in new money for its overseas operations.

One approach, often successful, to increasing the sales and profits of an enterprise, is *forward integration*. Forward integration signifies an upgrading of the product or products sold by a company, so that they either are finished end-use items or are developed to some intermediate stage which is closer to the end-use product. Thus, a company manufacturing vinyl chloride and polyvinyl chloride may decide to integrate forward by also producing products that can be made from PVC—Diamond Alkali Company, for example, has done just this.

A *major advantage of forward integration is that instead of having a* few dozen or several hundred customers for the intermediate, the integrated producer has thousands or even millions of customers for the end-use item. Therefore, the integrated manufacturer is not dependent upon a few customers, and he has a great deal more control over his product. Other advantages of forward integration accrue from higher profit margins on end-use products than on intermediates, elimination of sales and transportation charges for the intermediates, etc.

In the past five years many CPI firms have integrated all the way into manufacturing final consumer products. In some companies, consumer items are expected to return substantial profits—other companies will be and have been disappointed in the high cost of market introduction (advertising, promotion, product development, etc.).

Two of the early chemical industry entrants into consumer markets were Union Carbide's Consumer Products Company and Monsanto's Consumer Products Division. The former company produced antifreeze for the consumer as long ago as the 1920's and continues to do so. The following case describes some of the problems and marketing strategies surrounding Carbide's antifreeze market. Following the Carbide case is an article relating Monsanto's experiences in the consumer market of the 1950's. For Monsanto, an attempt at corporate growth via forward integration to the consumer market was not successful and the firm has withdrawn from this market.

13 Union Carbide Consumer Products Company

by Northwestern University School of Business

"Permanent" type automobile antifreezes enjoyed rapid growth after World War II, but by 1958 the market had become increasingly competitive. The growth of "price" brands and loss of effective fair trade laws in an increasing number of states plus a trend toward consumer acceptance of off-brand glycol antifreeze as "just the same" as the major brands had seriously affected sales of the major brand producers of antifreezes. Additional problems arose from the growing reluctance of automotive wholesalers to stock antifreeze prior to the selling season. In preparing its promotional plan for the 1958-59 selling season, Union Carbide Consumer Products Company, manufacturer of "Prestone" antifreeze, was faced with the problem of how to deal with the current market situation.

The antifreeze market had originated in the early 1920's when the spreading ownerships of automobiles and the improvement of roads caused an increasing demand for a coolant that could be used satisfactorily in below freezing weather. Denatured alcohol was the antifreeze adopted, and later in the thirties methanol (essentially a synthetic wood alcohol) was widely used. Both of these coolants boiled at relatively low temperatures, making frequent replacement necessary during a winter driving season. In 1927 Union Carbide Consumer Products Company, then the National Carbon Company, introduced "Prestone," a glycol-base antifreeze, which had a much higher boiling point and, hence, would last all winter. Other brands of glycol-base antifreezes were gradually introduced, but these "all-winter" or "high boiling point" types gained acceptance slowly. Methanol-base products continued to dominate the market until World War II, after which glycol-base antifreezes moved ahead rapidly. By 1957 glycol-base products accounted for 82 per cent of the total antifreeze annual volume (Table 1).

Advantages of Glycol Antifreezes

Generally, when enough methanol or alcohol-base antifreeze is placed in a cooling system to protect it from freezing at a temperature as low as 20 degrees below zero, the solution will boil at 180 degrees or less at

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Table 1 Share of Antifreeze Market Held by Glycol-Base Products for Selected Years[a]

Year	*Share of Market* *Glycol-Base*	 *Alcohol-Base*
1927	0%	100%
1941	20	80
1955	72	28
1957	82	18

[a]Share of market is based on gallonage produced. In dollars, the glycol share would be larger.

Source: *Printers' Ink,* March 28, 1958

sea level. Prestone and other glycol products have a boiling point of about 223 degrees under similar conditions.

Many modern high-compression automobile engines operate with cooling systems under seven to thirteen pounds pressure. Each pound of additional pressure tends to raise the boiling point of the coolant about three degrees. The purpose in operating modern automobile engines at higher temperatures is to obtain more efficient performance. Most thermostats now have start-to-open temperatures of 160 degrees or higher. This prevents the cooling solution from circulating through the radiator until that temperature is reached. The temperature of the coolant, however, may rise as much as 20 degrees after the engine is stopped and the pressure drops. If this happens, the margin of safety between the coolant temperature and the boiling point of methanol solutions vanishes, "after-boil" occurs, and the pressure of the steam in the engine water jacket can force the coolant solution out the overflow pipe. The higher boiling points of the glycol-base antifreezes make them less susceptible to this "after-boil" and hence more desirable. In addition, a very real danger of flash fire exists in using the methanol solutions should the solution be released from the cooling system and spill over a hot engine block. Some danger from the fumes of hot methanol also exists. These fumes are toxic and could be detrimental to the occupants of the automobile should a small leak develop in the heater of the car. These factors partially accounted for the tendency of glycol antifreezes to replace methanol products in consumer preference. An additional factor was the decline in price spread between glycol and methanol products. Glycol had steadily declined in price because of improved production methods while methanol prices were increasing.

The management of Union Carbide estimated that in 1957 about 101 million gallons of antifreeze were sold at retail—about 85 million glycol-base and 16 million methanol-base. As Union Carbide had been the first to market a glycol-base antifreeze, it had originally enjoyed the entire market. Competition had not entered until 1939 when DuPont introduced "Zerex." By 1957 there were over 200 competitive brands of glycol-type antifreezes on the market. Union Carbide's sales had steadily increased over the years, but its share of the market had been dropping as more competitors sprang up. Nevertheless, "Prestone" antifreeze was the largest selling brand in the industry.

Union Carbide also produced a methanol-base antifreeze called "Trek," but did not actively promote it. It had been introduced in the antifreeze market in the early 1940's when DuPont, which had until that time only marketed "Zerone," a methanol-base antifreeze, decided to market "Zerex," a glycol-base product. Union Carbide's reason for the introduction of "Trek" brand was to round out a complete line of antifreeze in order to compete with DuPont. However, by 1957, sales of "Trek" were still only a fraction of "Prestone" antifreeze sales. The average retail price of Trek was about $1.60 per gallon and the wholesale price to the service station was about $.90 per gallon.

"Prestone" antifreeze was distributed through two channels. The greatest gallonage was sold through automotive supply wholesalers who acted as agents for Union Carbide. They sold both to smaller jobbers and direct to dealers, primarily service stations and garages. On sales direct to dealers, the wholesaler's commission was 20 per cent, but on sales to other jobbers it was considerably less.

The second channel of distribution for "Prestone" antifreeze was to national marketers such as the large oil companies and automobile manufacturers. The number of these accounts was considerably smaller than the number of agent accounts and the product was sold outright in this case. Regardless of the method of distribution, Union Carbide suggested that "Prestone" antifreeze be sold at retail for $3.25 per gallon. Where fair trade laws existed, this price became the fair-trade price. Other leading national brands of glycol-base antifreeze such as "Zerex," "Pyro," and "Peak" also had suggested list prices of $3.25 per gallon at retail.

Company executives had looked forward to a constantly expanding market as the number of cars on the road increased. Although the number of cars was increasing, total sales of antifreeze were apparently fairly constant. The average 1957 model car required 6 quarts of antifreeze to protect it against freezing at temperatures as low as zero. In the three years 1955-58, the number of motor vehicles increased from 62 million to 67 million, but the sale of antifreeze dropped from 110 million gallons to 107 million. Leaders in the industry believed this paradox was partly the result of the use of the word "permanent" to describe glycol antifreezes. Some motorists had come to believe that these antifreezes could be used for several years or even indefinitely. Surveys had been made which indicated that about 40 per cent of all car owners used their antifreeze for two years or more.

Sales of antifreeze were also greatly affected by weather. Sales could vary as much as 10-15 per cent above or below normal depending on whether the winter was very cold or exceptionally mild. Sales had to be estimated and production scheduled almost one year ahead of the next selling season. Overestimation could result in costly warehousing and inventory extended over a nine-month period. Underestimation or maldistribution of product could result in sales lost to competition. Part of the sales drop from 1955-58 was the result of some mild winters.

Another marketing problem centered about a trend toward more antifreeze sales to consumers through outlets not offering installation service, such as supermarkets, chain drug stores, discount houses, etc. During the 1957-58 season an estimated 25 to 30 per cent of antifreeze sales were made through these outlets. A few years previously, automobile service type outlets accounted for 95 per cent of all antifreeze sales. The "over-the-counter" non-service type outlets' market penetration had been accomplished largely through lower retail prices. Retail prices ranged as low as $1.79 per gallon for some private brands as compared to the suggested $3.25 per gallon for the nationally advertised brands.

Union Carbide's management believed it could cope with price competition from private brands, but with the loss of effective fair trade laws in a great number of states, many non-service outlets had begun using "Prestone" and other national brands of antifreeze as loss leaders. Advertised retail prices in some cases were lower than wholesale prices. This type of competition was fairly new to automobile service outlets and in areas where it was most severe, traditional distribution channels were hurt. Service outlets in these areas tended to delay stocking of antifreeze until the season actually started, which resulted in increased warehousing costs for the company. Some service outlets reacted by refusing to push nationally advertised brands.

It did not appear that the declining trend of antifreeze sales through service type outlets would continue. Analysis indicated that service stations would continue as the primary outlets for antifreeze. Among other classes of retailers, only the grocery store approached the service station in local neighborhood locations. As compared to a grocery store's greater traffic, the service station was in a position to sell either "over-the-counter" or installed, offer sounder advice to the "do-it-yourself" trade as to quantity required and installation procedures, was equipped to service and test antifreeze protection for brands he handles, and was normally open seven days a week for long hours which was important if cold weather arrived suddenly. Also, newer model automobiles were becoming more complicated and the average car owner neither had sufficient skill nor the proper tools to install his own antifreeze.

Union Carbide had conducted continuing research for product improvement from the time "Prestone" antifreeze was first marketed. As a result, the company executives were convinced that "Prestone" was superior to any antifreeze on the market. The glycol base was essentially the same in all of these products; the important quality differences were in the rust inhibitor additives. A rust inhibitor of some type was essential in a glycol-base antifreeze because, with usage, the solution of antifreeze and water became acid and corrosive as a result of normal contamination with combustion exhausts. This contamination took place with any type of antifreeze. The mixing of glycol or methanol with water did not, in itself, increase the tendency for corrosion. If rust inhibitors were not present in any type of engine coolant, chemical reactions occurred with exhaust gases and rust was formed in the engine water jacket and the radiator. This eventually clogged the cooling system. Although borax was widely used as a rust preventive in antifreezes, antifreezes using borax were far from being equal to "Prestone" brand with its "two-phase" inhibitor which had been developed in its laboratories.

Union Carbide's two-phase inhibitor contained both a chemical inhibitor and a polar-film or magnetic-film inhibitor. The chemical inhibitor prevented the breakdown of the glycol through protection of the coolant from acid contamination and through reduction of the corrosive action of water on iron and other metals. According to the company chemists, the magnetic-film inhibitor formed a thin tough barrier between the coolant and the metal surfaces where all corrosion began. Union Carbide executives believed this exclusive blend of inhibitors would prevent the breakdown of glycol for a much longer time than the widely used borax inhibitor which was only a rust preventive. Their analysis of the better known, nationally advertised brands of glycol antifreezes indicated that no other brand currently being marketed carried an inhibitor combination equal to that used in "Prestone."

In spite of the fact that Union Carbide believed "Prestone" antifreeze was superior to all other antifreezes, the company did not advertise its product as a "permanent" antifreeze because executives believed the rust inhibitors in any antifreeze would eventually wear out with use. A statement from "The Engine Cooling System," a manual developed by Union Carbide for garage and service station men, summed up the company's thinking as follows:

> How long antifreeze will last depends on many factors such as cooling system condition, the speed and mileage the car is driven, and the rate of contamination. For example, even minor exhaust gas leakage into the coolant can break down the rust inhibitors in any antifreeze. No two engines are exactly the same and tests show that rust preventive life may vary as much as 4,000 per cent between two similar cars, depending on type of driving, mechanical condition, and general maintenance. There is no simple, dependable way to determine rust inhibitor condition in used antifreeze. Even complicated laboratory tests cannot tell how much longer the rust and corrosion protection will last. Rust-scale build-up in the engine starts before there is any visible sign of rust in the coolant.

This manual had been distributed widely to service station men and mechanics for over 25 years. Union Carbide also maintained a national field service organization staffed by about 30 technicians who were available for contact and consultation concerning any cooling system problem which might develop. The company felt that the goodwill developed over the years by this organization helped maintain prestige for "Prestone" antifreeze and enabled the firm to develop a valuable fund of information about cooling system problems. This information was of value to both the research and product development departments.

The advertising budget for the fall of 1958 was expanded considerably over previous years to a total of approximately $4.4 million.[1] $3 million of this was to be allocated to network television (Playhouse 90, Perry Mason, Cheyenne, Sugarfoot, a "Sportacular" on the eve of the World Series, NBC News). Another $800,000 was for radio spots on 544 stations covering 369 markets, and $600,000 was for newspaper ads in over 500 papers, including four-color, full-page Sunday supplement ads and a page in *The Saturday Evening Post.*[1] The themes plugged in these ads would be the "double guarantee" plan which would emphasize the importance of proper installation of antifreeze and the "Magnetic Film" protection of the radiator. The advertising program was designed to further promote Prestone's reputation as a top quality product.

The "double guarantee" advertising theme was based on a marketing idea which a number of the national brand manufacturers and large petroleum companies had decided to use. This idea was a guarantee to the consumer that the dealer installing the antifreeze would add additional antifreeze needed ". . . to restore protection lost from mechanical leakage, provided you have leaks repaired promptly." In the case of

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[1] Source of dollar amounts shown: *Advertising Age,* August 1, 1959, p. 164.

"Prestone," the "double guarantee" referred to the dealer's guarantee and the guarantee that Union Carbide had given for many years which stated: "Union Carbide Consumer Products Company, Division of Union Carbide Corporation, specifically guarantees that 'Prestone' Brand Antifreeze, if used according to printed instructions, in normal water cooling systems, will protect the cooling system of your car against freezing and clogging from rust formation for a full winter; also that it will not boil away, will not cause damage to car finish, or to the metal or rubber parts of the cooling system, and that it will not leak out of a cooling system tight enough to hold water."[2]

To gain dealer support for this plan, Union Carbide planned a sales program in which dealers were given free instruction booklets, customer guarantee "logs," dealer guarantee stickers, and tie-in posters. A price schedule as shown in Table 2 was established.

Table 2 "Prestone" Antifreeze Price Schedule: 1958

Size of Can	*Cans per Case*	*Wholesale Price per Gallon*		*Suggested Retail Price per Gallon*
		Unbroken Cases	*Broken Cases*	
1 gal.	6	$2.17	$2.50	$3.25
1 qt.	24	2.27	2.60	3.40

On all orders for delivery prior to October 31, 1958, an allowance of 6½ cents per gallon was given to the dealer. It was estimated that this allowance would exceed the cost of any replacement of antifreeze made under the guarantee, particularly if the dealer did a proper job of "readying" his customers' cars before installing "Prestone." It was emphasized, however, that dealers did not have to use the dealer guarantee part of the plan; the dealer could write any guarantee plan he wanted to, including no guarantee at all. Union Carbide's guarantee would remain in effect regardless of the dealer's action in this respect, and orders for delivery prior to October 31st would receive the 6½ cents per gallon allowance regardless of whether or not the dealer used the guarantee plan.◆

1. Was the "Prestone" marketing program for 1958-59 sound?
2. Are there any other marketing strategies which Union Carbide could use effectively in addition to, or in the place of, the promotion plan established?

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[2] Source: The Engine Cooling System, a Manual for the Service Man; Union Carbide Consumer Products Company, Division of Union Carbide Corporation.

14 Monsanto Yields Consumer Field

from Business Week

Monsanto Chemical Co., reversing a major postwar policy of getting closer to the consumer, has decided to drop out of direct consumer product competition.

That's the real meaning behind last week's announcement by the $546-million company that it was turning over its low-suds detergent "all" to Lever Bros. In effect, Monsanto was admitting that the razzle-dazzle and steep promotional budgets of a consumer field such as soaps and detergents just didn't fit into the long-range plans of a basically industrial producer.

With the sale of "all"—No. 1 product in its field—Monsanto also disbanded its Consumer Products Div. Last week Lever Bros. executives were in St. Louis interviewing Monsanto's consumer personnel who may want to shift to the Lever operation. Only Vice-Pres. Roy L. Brandenburger, who headed the consumer division, and a few others will be absorbed into Monsanto's other operations. Others—in sales, marketing research, and promotion—will either go to Lever Bros., be reassigned at Monsanto, or offered severance pay.

Close of an Era

Thus ends the big chemical company's coordinated attempt to sell some of its products to the mass consumer market.

At one time, Monsanto had as many as nine products in consumer package sizes. They included Krilium (soil conditioner), Folium (water softener), additional versions of "all," Bogey (pesticide-fungicide), and D-Leet (a selective herbicide). By now most of them have been quietly dropped. This was because Monsanto either had to broaden its line in

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these fields to make the promotional expense worthwhile, or get out. It chose the latter.

Krilium is still available, but is being sold in bulk lots through the Plastics Div. to ball parks and golf courses. Monsanto's Rez, a wood finishing product, is being handled through the Organic Chemical Div. for sale to hardware, paint, and lumber dealers. A line of farm chemicals with their own trade names, announced last year, will also be sold by that division.

Big Decision

The decision to get out of consumer merchandising ends at least six months of corporate soul-searching. The tipoff that something was brewing came in the company's annual report earlier this year. Stockholders were informed by Chmn. Edgar M. Queeny: ". . . we face the reality that our consumer products line is not now broad enough to support a completely competitive merchandising organization."

Here was clear evidence that the highly diversified industrial chemical producer considered the merchandising costs in the red-hot over-the-counter retailing field out of proportion to the company's other activities.

Monsanto will still manufacture "all" products under an undisclosed "working agreement" with Lever, but the promotional problem will be thrown into the lap of Lever, a company long accustomed to peddling soap.

Consumer Taste

Monsanto got its first taste of consumer merchandising in 1952 when it started packaging Krilium for retail sale. That product was an overnight sensation. Its initial success laid the foundation for the company's consumer stint, with Roy Brandenburger hired from Ralston Purina Co. as the first "Mr. Retail Monsanto." Eventually, though, Krilium petered out, largely because of a price that was too high for the consumer market.

"All" too, was a big selling product right from the beginning. Unlike Krilium, it maintained its original pace almost up to the end. Annual sales were running between $30-million and $40-million, and it was unquestionably a profitable item.

Origins

It was developed when Westinghouse Electric Corp., in 1947, went to Monsanto for a controlled-suds detergent for the new automatic washer it planned to make. At first, distribution was handled through Detergents, Inc., but as "all" sales climbed Monsanto acquired that company and took over distribution. Ever since, "all" has been the mainstay of Monsanto's consumer business.

It was a good arrangement for Monsanto, since its Consumer Products Div. bought the raw material from the Inorganic Chemicals Div., and thus the company enjoyed profits at both ends.

Up until last year, "all" sales climbed steadily. But in the annual report, Monsanto noted that consumer sales (almost entirely from "all") dropped some 9% "in a highly competitive market," although latest reports for 1957 show sales again turning upward.

What happened was that other soap manufacturers—Procter & Gamble, Colgate, Lever Bros.—had watched "all" take off, then came out with their own versions, including Dash and Ad. Lever tried to market Vim, but that never went over. By getting "all," Lever now is in a position to compete with P&G and Colgate. Lever's $60-million promotional budget—against no more than $3-million to $4.5-million for Monsanto—will allow it to pit "all" against the inroads of its competitors' Dash and Ad.

Success Story

Actually, Monsanto had done a spectacular job in merchandising the product. It won acclaim from the consumer industry, especially for its newspaper advertising campaign, which tied in heavy promotion with manufacturers. Washing machine producers would include a box of "all" in their machines when customers bought them. Other soap companies have followed similar campaigns.

In fact, "all" may have been a little too successful. In the soap business the sudsy powders still rank this way: P&G's Tide and Cheer in the No. 1 and No. 2 spots and Colgate's Fab in No. 3. When "all" moved into fourth position, it virtually forced the others into a low-suds product. Both Dash and Ad are now being heavily promoted, and it became clear that "all" would continue to require substantial promotional expense.

Supplier, Too

Monsanto apparently decided it wasn't worth battling the giants. They were already unhappy about Monsanto's venture into the consumer field. For years Monsanto has been a big supplier of raw material—phosphate chemicals—to the soap industry. As a matter of fact, with about 35% of the national phosphorous output, it doesn't have to worry right now about customers.

But three competitors—Victor Chemical Works, Westvaco, and Shea Chemical Corp.—have been moving into phosphorous, and production has jumped appreciably. Hence, Monsanto apparently could see a long-range threat to its position as a raw material supplier.

With Lever now merchandising "all," will P&G and Colgate still be mad? The feeling is that they won't be nearly so angry fighting Lever as they were competing against their own supplier.

In a well-run organization, there is no one department or group which can be pointed to as the part of the firm that is responsible for growth. Each part of the firm must set its objective so that it tends to maximize the overall objectives of the firm; this often necessitates submerging the departmental view in the interest of the long-term success of the enterprise. Therefore, it becomes management's task to properly balance the objectives of the parts in the interests of the whole, i.e., to integrate into a cohesive and efficient structure the various organizational units such as production, finance, engineering, research.

When such an efficient organizational structure is developed, the efforts of the firm can then be turned to growth. There is no reason for the enterprise to limit the growth techniques it uses—merger, acquisition, research and development, etc. can all be used to expand the long-term profits of the firm.

The following article relates how a major chemical company, Hooker Chemical, utilized a variety of means, over a long period of time, to become a successful and recognized *growth* company.

15 The Care and Feeding of a "Growth" Company

by Robert Lindley Murray

I would like to talk tonight about the care and feeding of a "growth" company—the one I know best, the Hooker Company. If you find what I am going to say of any interest, it will certainly not be because ours is the biggest, or the best known, or even the most dynamic of the chemical companies. It is, however, in many important ways unusual and while we cannot claim that our company is one in a million, we can claim, and do, that it is one in several thousand. There are about 4½ million

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companies in the United States of which only a few, perhaps a thousand, can be considered "growth" companies. The Hooker Company is one of these. "Growth" companies are, therefore, rather special and like anything rare and unusual they demand rather special attention. They impose certain out-of-the-ordinary demands upon their management and in return offer out-of-the-ordinary rewards.

To begin, I might establish in a general way what a "growth" company is. Perhaps the members of the financial fraternity who are here tonight will allow me this definition: a "growth" company is one which has grown at a faster rate than the average of all companies and gives every evidence of continuing to do so into the indefinite future. Because my background is in chemical engineering, not astrology or the other occult sciences, I will not undertake to say with any precision how much and how fast our company will grow in the future, but I can demonstrate precisely its growth in the past. Perhaps the simplest means of illustrating this growth is in terms of stock market values. The Dow-Jones industrial average during the past 20 years has increased about 240%, while our stock has increased nearly 6000%. In the same period our sales rose from about $4½ million to over $94 million. To put it more graphically, a $13,000 investment in Hooker Common in 1935 would be worth today, with accumulated dividends, somewhat more than a million dollars. I think anyone would call this growth.

It would be nice if we could pretend that our extraordinary growth is due to nothing other than managerial genius. The fact is, however, that we have been, to some extent, the almost automatic beneficiaries of a growth industry. The basis for that growth is in evidence wherever we look.

Over the years, the chemical industry has introduced the inexpensive, high-quality dyes, medicinal products and flavours made from coal tars; it has developed high-strength, colour-fast plastics which have substituted for the more expensive china, marble, tortoise-shell, metals and wood. It has given us tyres that last five times as long and cost as much as in 1920. It has given us the life-saving "wonder drugs," the Salk vaccine, and cortisone. It has given us many new and wonderful synthetic fibres; it has recently given us pills that prevent sunburn and window panes that can be nailed into place; it has even tapped the ocean for bromine and magnesium, and has given us new metals. In the late 1930s a standard dictionary defined titanium in part as "a dark-grey metallic element which has no important uses," but within a decade titanium was being produced commercially. Today many of our jet planes would be unable to fly without it and it has become a vitally important metal. Titanium's development has been essentially a chemical process.

During the past three decades alone, the chemical industry has introduced nearly 6000 new chemical products and last year placed new products on the market at the rate of more than one a day. No wonder, then, that for the past 30 years the chemical industry has grown over three times as fast as the average for all industry, and that its sales have skyrocketed from $3 billion to $23 billion. It is hardly surprising, therefore, that the Hooker Electrochemical Company, as part of this dynamic industry, has shown a striking growth of its own. Had we been manufacturers of whaling ships, or anvils, or buggy whips, and shown the same rate of growth, we could lay fair claim to being the world's most ingenious industrialists, but as manufacturers of chemical products we could hardly fail to grow. Nevertheless, with every allowance made for favourable conditions our growth has been exceptional.

Naturally, in seeking reasons for growth it is a temptation to emphasize the big, dramatic things—a new favourably situated plant, or development of a new especially successful product. But growth begins with much less striking things—with the day-by-day decisions that result in quality products, which are efficiently produced and fairly priced. To achieve these ends management is somewhat in the position of a conductor who leads a large, enormously complicated symphony. Among the instruments in the industrial orchestra are sales, engineering and production; research, accounting and purchasing; general development, legal work and patent work; and industrial relations, financial relations, and public relations. These, and many more must be meshed into one harmonious whole, although they often seem to play conflicting tunes.

For example, production's principal function is making, at the right time, enough tons of the right products of the proper quality at the lowest possible cost. Industrial relations' end function is to assure high productivity per worker and low labour turnover, which depend in a large part upon good pay, steady employment and good working conditions. Yet if the pay and working conditions become extravagant, the production department would find it difficult to produce chemicals that could be competitively priced. Nor could we, under such circumstances, support an aggressive research team, or supply engineering with the proper materials and equipment, or keep our stockholders happy.

Every department, then, must be kept in proper balance: in engineering there must be efficient designs and durable construction at reasonable capital costs; in production—the right processes, the proper materials and the best planning; in industrial relations—good working conditions and the highest employee morale; in research—imaginative, highly-trained personnel equipped with the best apparatus and intelligent sympathetic leadership; in sales—an alert, aggressive organization selling properly-publicized, fairly-priced products; in administration—there must be skilful accounting, high-grade legal help, efficient purchasing, sound financing, and a great deal more. All these instruments must be kept in proper tune if the industrial orchestra is to function, while a "growth" company requires even more—a near perfect balance and harmony.

Achieving this harmony is management's principal function. If it succeeds it does so by meeting decisively a deluge of day-in-and-day-out problems. It can meet these problems only by performing exceptionally well under what Lydia Strong, in an article in the *Management Review,* has called "The Ordeal of Executive Decision." As Miss Strong pointed out, "The first group Dante met in the inferno were the wretched souls of those who could not make up their minds. They lived without blame and without praise. Heaven cast them out and hell would not receive them." The management of a "growth" Company may have its wretched souls, but not because they are indecisive. You may be certain they are earning a welcome either in heaven or in hell.

Decisions, of course, must pay off, and for us, our most important decisions have paid off in growth. In the 1930s Hooker decided to intensify its research programme. Not long after our programme was inaugurated, Charles F. Kettering, creative genius of General Motors, defined the purpose of a research programme as follows: it is "to find out what we are going to do when we can't do what we are doing now." Our research programme now has us doing numerous things which we could scarcely have imagined in the early 1930s. Above all, it has given us scores of new products which have given us a powerful push in the direction of rapid growth. Despite the happy results of our research programme we were not by any means in clover; we found ourselves missing out in plastics, one of the chemical industry's most rapidly growing fields. We improved this situation by developing a line of fire-resistant polyesters, which we call hetrons, and by solidly establishing ourselves in phenolic resins and moulding compounds through our merger last year with Durez Plastics and Chemicals. Now we are using our position in polyesters and phenolics as a springboard into other plastics. When we merged last year with the Niagara Alkali Company, Hooker was catapulted into still another field—potassium chemicals. We have every expectation that our potassium products will play an important rôle in our future growth.

Another, perhaps more unusual, reason for our growth is that over the years we have kept an especially watchful eye on growth regions, and have located plants in several of these areas. The Pacific Northwest is a case in point. As early as 1912, our company investigated this section, but concluded that there was not enough demand to justify a

West Coast plant. Its enormous potential was recognized, however, and by the 1920s the Northwest had begun its tremendous growth. In 1929, we located a plant at Tacoma, Washington; it was the first chlor-alkali plant in the Pacific Northwest. Our watchfulness paid off handsomely. Since our Tacoma plant went into operation, the Northwest has grown at a rate considerably above the National Average. Our plant, keeping pace with this growth, has increased capacity more than 1300% during the past quarter-century and we are still striving to stay abreast of demand. We are now building a new plant in Vancouver, B.C., to relieve pressure on Tacoma and to provide for today and tomorrow's chlor-alkali needs in fast growing Western Canada.

We are seeing similar signs of growth at our new Midwestern plants in Kenton, Ohio, and Montague, Michigan. The Montague plant, which went into production two years ago, has now been joined by a Du Pont plant for the production of neoprene synthetic rubber and a Union Carbide plant for the production of acetylene. Montague, it would appear, is on its way to becoming one of the Midwest's important chemical centres. Getting in on the ground floor in such fast-growing areas has certainly been no hindrance to our growth.

Still another, and to us quite interesting, reason for our growth, concerns some of our financial friends who are here tonight—the security analysts. Until a decade ago Hooker stock was unlisted and closely held, but by the end of World War II it became clear that capital requirements for our expansion would necessitate listing our stock on the Exchange. This was done in November, 1947. Within a short time, substantial blocs of our stock had been bought by investment houses, and we found ourselves with some new owners who had a keen professional interest in our progress. We discovered quickly that their representatives, the security analysts, had rather lofty ideas of where we were going and how soon we would get there. They have put us in the limelight and expect us to produce. Their expectations offer a public challenge unlike anything we faced when our stock was closely held and management accounted only to itself and to relatively few stockholders. This year, for example, a number of security analysts have forecast that our earnings will hit what may seem to be a rather ambitious figure, but we have made this figure our goal and are making every effort to see that we achieve it. The representatives of investment houses, we find, act as a spur to management. This has been a quite unexpected advantage of being publicly owned.

All of these factors, plus our management training programme, our process study group, our grass roots budgetary control system, our general development department and many more, have helped to make us somewhat out of the ordinary. And as I have mentioned earlier, a "growth" company makes out-of-the-ordinary demands upon its management. In this respect, a "growth" company bears about the same relation to a non-growth company as chess bears to draughts or jai alai to ping pong; one is vastly more demanding than the other and you must work proportionately harder to succeed. A good illustration of this can be drawn from one of our new, fast-selling products. Five years ago we were selling a negligible tonnage of this material, last year the tonnage became very substantial and this year our most optimistic estimates are being exceeded. Products such as this one help us to grow, but they also keep us burning the midnight oil. For example, we have had to engineer new production facilities, supervise their construction, and recruit highly trained people to operate them. We also have had to install additional facilities for chlorine, the basic raw material, and, as many of you know, we cannot manufacture chlorine without producing chlorine's co-product, caustic soda. As a result we must undertake further research to find markets for the additional caustic soda, to say nothing of finding additional markets for the hydrochloric acid which is produced as a by-product of our material. These are but a few of the problems created by successful new products. Without such products we might be able to put our feet up and relax occasionally, but without them we would not be a "growth" company. These are the kind of problems we welcome and we would be disappointed if the future failed to hold a great many more.

Any company which intends to stay in business must, of course, keep an eye on industrial trends, technological advances, and shifts in population and consumer preferences. A "growth" company, we feel, must do a little extra homework in this direction. A "growth" company's management must also undergo a certain amount of financial brainwashing. Rapid growth very quickly plunges management into what is too often a bewildering world of "convertible debentures," "paid-in-surpluses," and "miscellaneous accruals." There are no route markers through this maze and the only way out is by management putting an end to its financial innocence.

Management would be remiss, too, if it failed to study possible future acquisitions. There are some chemical lines in which sound growth can be achieved quickly only by merger with companies already solidly established in those lines. Durez in phenolics and Niagara Alkali in potassium chemicals are two examples with which we, of course, are familiar. A "growth" company's management, therefore, must work overtime studying proxy statements and financial reports, and projecting the future of companies with which it might one day wish to merge.

A merger, of course, places an enormous burden on the shoulders of management. Some of the more perplexing problems are: what will be the organizational set-up of the continuing company? Should sales, engineering, accounting, purchasing and research of the merging companies be consolidated or kept autonomous? How should separate and distinct pension plans be reconciled? And how are salary schedules to be brought into alignment? One of the knottiest problems of all is the merging of personalities; the blending of experienced, talented individuals with differing viewpoints and philosophies into a single, smoothly-functioning group.

In solving these problems we run the risk of what *Time* Magazine has called "The perils of table sitting." The perils of table sitting, of course, are not peculiar to "growth" companies. Because of the complexity of modern business it has become increasingly difficult for executives to make decisions individually and a great number of decisions must be made around the conference table. The peril, of course, is that while conferences sit, the wheels of production will grind to a halt. Because of the unusually large number of problems which face a "growth" company, it runs the risk of table sitting almost precisely in proportion to its growth. Its management must be especially artful in avoiding this built-in pitfall.

The central, over-riding problem of a "growth" company is to maintain its status. It must keep growing at a rate significantly above the average. To do so, as I have tried to indicate, requires vision and imagination, but more than that, it requires a tremendous amount of plain hard work.

Managing a "growth" company is not, however, all work and no play, or at any rate, no pleasure. A "growth" company offers management quite out of the ordinary rewards—rewards entirely commensurate with its out-of-the-ordinary burdens. Among the pleasurable side-effects of managing a "growth" company is the satisfaction of being able to promote able young people much faster and more often than would normally be the case. Within the past eight months we have been able to promote 20% of our management group, a figure we imagine to be considerably higher than the average. There is also the excitement of being able to undertake large projects formerly out of reach. We had to achieve a certain growth before we could merge with Durez or Niagara Alkali and before we could even consider a new $2,000,000 research centre, or the establishment of a company to supply salt, our basic raw material, to our Western plants. There is also a discernible glow of satisfaction among our employees. They have a sense, as one of them has put it, "of being on a winning team." We all have the ultimate satisfaction of seeing our products, our plants, our profits and our company grow.

In spite of the chemical industry's phenomenal growth in the past, a great deal more is expected of the future. Even the most conservative view of the future promises tremendous growth. Within the next two decades our population is expected to be something like 215,000,000 and, in a great measure due to chemistry, these millions of Americans will live richer, healthier and, we must presume, happier lives. There will be new drugs not only for curing diseases but for preventing disease and promoting good health; there will be new, more beautiful, longer-lasting fibres and plastics; and with our progress in fermentation with bacteria and yeasts, there will even be new foods. There will also be the sterilization and preservation of foods by atomic rays and the cooking of foods by microwaves. There will be the extraction of more metals and minerals from sea water, and by harnessing the rays of the sun there will be solar energy to compete with atomic energy.

All of this will mean an enormous growth in our industrial machine. As our economy and our industry grow, our company will grow, and with a little special care and feeding, we are confident it will continue to grow at least a little bit faster than the average.

The previous cases and articles have illustrated how a United States chemical company grows. But the problems of growth in other nations are significantly different, with a major emphasis being placed on solving political and social issues rather than upon technical or commercial problems.

The record of an Italian growth company, Montecatini, serves to demonstrate how different the foreign firm's external environment can be. Montecatini, Italy's second largest privately owned industrial firm, responsible for two-thirds of all Italian chemical production, has grown more than one-hundred-fold since 1944. Yet, this was done in an environment for which the word "hostile" would be a marked understatement. Montecatini had to contend with Communist workers and governmental officials, with competing government monopolies, with an environment in which privately held firms are not protected by anti-trust laws or fair trade practice acts, etc.

The growth history of this successful company, already too large for Italy and expanding into other nations, is presented below.

16 Montecatini: Italy's Chosen Instrument

by Richard Austin Smith

"If you invest in Montecatini," concluded Count Carlo Faina, with a smile as captivating as the tall red roses on his escritoire, "you invest in *Italy!*" It was a rather disconcerting statement, particularly coming at the end of the president's unsentimental analysis of just why Americans could be expected to buy the securities that Montecatini, at long last, was listing on the New York Stock Exchange. Did President Faina imply that U.S. investors—a casehardened group whose financial romanticism rarely went beyond reading the business novels of the day—might undertake a private Marshall plan with their own funds? The very coupling

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of company with country transferred attention from Montecatini, so manifestly equal to its $400-million affairs, and focused it outside, upon the wintry streets of Milan. There some of Italy's two million chronically unemployed slouched along in the shadow of the splendid buildings the company had built of its own marble and aluminum, and the ground shook with the passage of a nineteenth-century trolley car, the *gamba de legn,* "the small train with the wooden leg." Yet Count Faina knew what he was about in pointing up the interrelation of Italy and its greatest mining and chemical enterprise. For if ever a corporate history paralleled that of a nation, if ever a company has had to win its way over the social, political, and economic problems that plagued the mother country, it is Montecatini.

Like Italy, Montecatini was run for decades by a dictator—Guido Donegani, the overbearing genius who built an exhausted mining outfit into the country's most diversified industrial empire. Like Italy, the company's reign of absolutism came to an end with World War II and the same agonizing renaissance followed. While the nation struggled to replace "the lost generation" of political leaders, Montecatini struggled to replace a lost generation of corporate leadership, trying to piece together an independent management from its too submissive older executives and its too inexperienced younger ones. The Communists took over the labor unions, obstructing what little production could be got from plants 70 per cent destroyed in the war. Yet gradually, encouraged from the top and impelled from the bottom, industrial democracy began to manifest itself at Montecatini. And as Italy can now lay claim to having made greater postwar progress than any of Europe's other industrial countries save West Germany, so Montecatini can point to an equally fabulous regeneration.

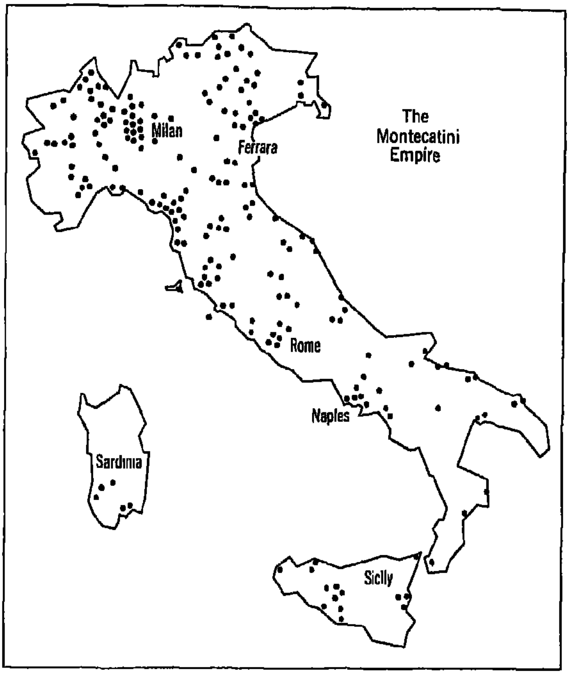
Today, Montecatini is second only to Fiat as Italy's biggest privately owned industrial complex and, too large for Italy, it must now battle all comers for a fatter slice of the world's markets. The company's revenues for 1956 amounted to $240 million; those of the Montecatini Group (the corporation and its affiliated enterprises) came to $400 million, an eighty-fold increase over sales only twelve years ago. Montecatini has achieved tenth rank among the world's chemical companies, employing 60,000 people in 167 production units. No internal market worth attention nor promising raw material but has been explored or developed by Montecatini, whether it meant building an aluminum smelter in the wilderness of Calabria, a power plant in an Alpine cavern, or a fertilizer factory on some malarial marshlands reclaimed from the lagoons of Venice.

As a fully integrated producer of inorganic chemicals, Montecatini begins with its own pyrites and works up to the prime building block of sulfuric acid and its derivatives on the one hand, while on the other its fixed-nitrogen plants produce ammonia, nitric acid, and urea. In the organic field, natural gas, crude oil, and Montecatini coke are turned by the company into basics for a second broad group, petrochemicals. The net of all this is that the average Italian is confronted by Montecatini at every turn. Roughly two-thirds of Italy's total chemical production comes from its plants. In the neighborhood shops, there's Ducotone paint, fabrics of Montecatini acetate and nylon, plastics like polyethylene. At the drugstores, the shelves are loaded with products of the Farmitalia affiliate, the biggest pharmaceutical company in the nation. On the farms, Montecatini insecticides help beat the once uncontrollable olive fly, guard grapevines from blight, while its fertilizers restore soil fertility to a nation still substantially agricultural. Even the coins in Italian purses are made of Montecatini aluminum.

Tiger in the Toils

Inescapably, then, an investment in Montecatini is an investment in Italy, and, one might add, in much of the *best* of Italy. For Montecatini today is the very antithesis of the American stereotype of an Italian company. It is *not* an autocracy dedicated to limited production at high price, corseted with a double set of books, indifferent to research, contemptuous of the professional manager and all his works. Rather it is an adventurous, highly articulate corporation, which is showing by example how necessary it is and how profitable it can be to make a break with the past.

At the same time, it would be a mistake to assume that because of all this Montecatini is an amiable giant with a soft spot for the public welfare. It is not. It is a big, tough, powerful company with a special talent for making any social contributions pay off economically. Nor is there anything to suggest that though the company has learned the value of being a domesticated tiger, it has forsaken all its jungle instincts. By our own antitrust standards, Montecatini is a monopoly in many fields. It produces 60 per cent of Italy's nitrogen fertilizers, 60 per cent of the phosphate fertilizers, 45 per cent of the lead, 80 per cent of the bauxite, 60 per cent of the aluminum, 60 per cent of the fixed nitrogen, 90 per cent of the pyrites, all of the petrochemicals as well as significant percentages of other key materials (see map on page 191). And, unabashed about using this monopoly power, Montecatini knows just how to claw up a



No. of Facilities		*Est. % of Italy's Production*
63	Chemicals	
	Agricultural	70
	Industrial	70
48	Mines, quarries, and sawmills	
	Bauxite	80
	Pyrites	90
	Sulfur	20
	Marble	10
8	Nitrogen	60
1	Petrochemicals	100
17	Nonferrous metals	
	Aluminum	60
	Lead	45
	Zinc	25
7	Textiles (including jute)	
	Synthetic fibers	85
3	Dyestuffs	60
2	Pharmaceuticals	50
13	Power stations (per cent is kwh)	8
27	Branch offices	
5	Research institutes	

The face of Montecatini, as this map shows, is the face of Italy. Its factories and workshops truly extend, in the rolling prose of a former chairman, "from the Brenner Pass to Etna, from the Ligurian Sea to the Julian Alps." The locations of the company's older plants and mines were determined more by the acquisitiveness and instinct of its guiding genius, Guido Donegani, than by any formal plan. On the other hand, the postwar reconstruction and new installations were meticulously planned with the object of making the sprawling complex a coherent whole.

competitor. When the Milanese firm of Idroxa built a plant to make hydrogen peroxide (only Italian manufacturer: Montecatini), the price of the chemical took a sudden calamitous drop. Idroxa's bankers, a private firm close to Montecatini, got nervous about their money and backed out of the deal. Montecatini took the hydrogen peroxide machinery off Idroxa's hands. The price of hydrogen peroxide went back up.

The same partiality for the jugular vein is often as characteristic of Montecatini in non-monopoly areas. The feeling among its smaller competitors is that the company will permit them to grow just so big—any expansion beyond that unspecified point will bring it roaring down upon them. Squibb of Italy, for instance, had just completed its modern plant in Rome in 1951 and was set to offer real competition to Farmitalia with a line of antibiotics, vitamins, insulin, and other ethical drugs. According to Squibb's managing director, Franco Palma: "We had every corridor in this plant loaded up with streptomycin, even the cafeteria was full of it. But Montecatini had got an import license to bring in streptomycin and started shipping in huge amounts of it just as we got started marketing. Montecatini almost had us bankrupt. We went into the red $5 million. I had to break off a six-week trip to the U.S. and come back and personally sell $3 million worth of antibiotics. We proceeded to meet Montecatini at any price they wanted. We got them to cut back their imports that way—we were even ready to offer the stuff gratis."

The way of the predator, however, is by no means uninhibited in Italy. Though the government has no antitrust laws with which to regulate business, its sheer appetite for power leads it to intervene on a hundred other pretexts. Indeed, something of a carnivore itself, it preempts the most promising game trails and arranges matters so that all the industrial tigers are encumbered with a set of lead paws. Few corporations anywhere, and certainly none in the U.S. are as hobbled by bureaucracy as those in Italy. Montecatini never knows what its tax bill is on any given amount of income; taxes are "negotiated" with the government. It has no control over the prices for roughly 30 per cent of its sales; those on agricultural chemicals, being for the farmer, a political customer, are fixed by the government on a political basis. It has had to sit by and see the government make the petroleum areas of the nation a preserve for its own corporate creature, E.N.I., while maintaining so hostile an attitude toward oil development by private industry that Gulf, Montecatini's onetime partner in a petroleum company, pulled out of the mainland altogether. In short, while Montecatini itself represents much of the best of the New Italy, the company still operates in a national environment that reflects some of the worst holdovers of the old corporate state. Its present management deplores such a circumstance, but the fact is the corporation can no more escape this than it can shake off the shadow of its own past.

Prelude to Progress

That past is largely the history of a single man, Guido Donegani, who put Montecatini together in the heyday of Mussolini's power and was ousted from office as soon as the dictator fell. At this late date, it is almost impossible to weigh the charges brought against him then by the National Committee of Liberation, and it must be noted he was subsequently exonerated of being a doctrinaire Fascist. Yet for all of that Donegani was a Fascist senator and a power in Mussolini's key instrumentality, the Fascist Confederation of Industrialists. When Il Duce visited Milan, it was always Donegani who climbed into Facist uniform and, matching even Mussolini in the protrusion of his eyeballs, made himself indistinguishable from the black-shirted "heroes of 1922." In view of such conflicting testimony, no more need be said than that Donegani played the Fascist game for all it was worth to Montecatini, the cynosure of his life. He bucked Mussolini's forced-growth policies where they imperiled his company's soundness, while luxuriating in Fascism's support of Montecantini's regional development and Fascism's guarantees of lucrative domestic markets for Montecatini production.

But what is important to an understanding of the company today is not whether Donegani's Fascism was perfunctory or pernicious; it is rather that, an autocrat by nature, he was just as preoccupied with creating absolute industrial power as Mussolini was in creating absolute political power. He gave none of his subordinates any authority. He insisted on being always right, even though he very often was. The gulf between himself and his executives was implicit in the fact that even his second-in-command never got an invitation to sit down in the boss's office, while in between himself and labor stood the feudal concept that employees should be as grateful as serfs for being sheltered in the industrial citadel he had built. And finally, when his power was broken and he was simply a querulous old man hiding from the authorities in a Roman seminary, he was still preoccupied with thoughts of industrial autocracy, of rigid and all-pervasive discipline from the center. "It may seem a heresy coming from me," the long-time anti-Communist confided to a friend, "but if I could be sure that Italians would find their faith in work again, I should be ready even to become a Bolshevik."

Unhappily for Montecatini, the bulk of its workers were ready, and for just the opposite reason, to swap industrial tyranny for political tyranny. Eighty-three per cent of them joined the Communist union in 1945, while at the management level the Communists were in virtual control of a rump committee that the Italian partisans had set up to run the company. This hoarse group of seven, headed by a Communist draftsman (all are still in Montecatini's employ), found its first task simple enough: tramping through the red-carpeted Palazzo Montecatini and telling their old bosses to get packing. But even the most ignorant among them soon understood that monumental management problems were now theirs to solve. An abbreviated bill of particulars on Montecatini at that time might have looked something like this: productive capacity 70 per cent destroyed; no materials or parts for repairs; no transport; no communication between plants in north and those in south; impossible to reduce labor force of 35,000 to 40,000—law required employees be kept on and paid even if no production; anarchy in plants, incompetence in offices. The committee prudently decided to hold up on some of its executive purges.

Among the key men retained in those first impassioned days was General Manager Carlo Faina. Why Faina? Under the circumstances, his selection seemed spectacularly illogical. Faina had been more of a Fascist than any of those run out of the company. In addition, was he not patently a Donegani man, a protégé who had served him well, initially as secretary? One reason, undoubtedly, was the success Faina had had collaborating with the Anglo-Americans in 1943-44. Concluding both that the war was lost and that an invasion would split Italy (and Montecatini) in half, he had won a reluctant consent from Donegani to set up a second corporate headquarters, in Rome. The idea, successfully carried out, was to cooperate wholeheartedly with the occupying armies and get production going again in the territory under Allied control. But an equally good reason behind Faina's uninterrupted tenure at Montecatini was that the Liberation Committee didn't quite know how to cope with him. Both a papal count and a royal count of an ancient Umbrian line, a doctor in law as well as economics, three times decorated for valor in World War I, thoroughly experienced in all aspects of the company, he was an impressive man. And if they didn't know how to handle him, he knew how to handle them. He listened attentively to the Communist chairman-draftsman who denounced him as a reactionary, boasted of the "new force" that was now abroad in the land, and ended up with the stock phrase of dismissal: "You are nothing now." Then while the latter paused for breath, Faina invited him and his committee to come into the office and talk things out. He answered all the tough technical questions that were troubling them and in the political field conceded that he had, indeed, been a Fascist. Finally he put some searching questions of his own to each one of them: "What have you against me? I have been in this company for twenty years, can any one of you say I haven't done my duty? Can you say I did anyone any harm during the Fascist period?" Nobody spoke. At last the uneasy chairman conceded: "We admit you're an honest man, but we don't know what to do with you. Anyhow, you can continue to be our general manager for the time being." From then on, Carlo Faina ran the corporation from behind the scenes—even if, for the next two years, his situation as an ex-Fascist demanded that other men nominally occupy the No. 1 spot.

Belly Logic

Faina's initial efforts were bent on getting fertilizer production going again ("first, Italians had to eat"). That meant restoring or rebuilding the nitrogen plants, some of which had been dismantled, with their equipment carted off to Poland and East Germany. It also meant making do with little but ingenuity. For instance, a rifle-cartridge factory near Turin was transformed into one for making fractionating equipment; its skilled metalworkers produced the complex copper vessels that today are still extracting nitrogen from air at 200° below zero. Next on Faina's priority list was resumption of sulfuric acid output, of paramount importance in Montecatini's chemistry. The deeply flooded sulfur and pyrite mines were pumped out; lead was scavenged from a hundred sources to replace that chopped out of the sulfuric acid plants by the Germans. The number of Montecatini's active production units went from forty-five to seventy-six during 1945, hit 100 in 1946, 140 in 1947.

Reconstruction, of course, cost money, but Faina was good at getting that too. He denied the stockholders a dividend in 1945 (the only time Montecatini has ever skipped a payment) and then, compounding the injury, notified them he was going to double the number of shares outstanding. Old Donegani, sitting on the sidelines, shook his head reprovingly. "Our country is so poor," he told his protégé. "You are rash to do this now; wait. Why do you think people will buy?" Faina thought they'd buy because Montecatini could sell anything it could make and there wasn't much else Italians could put their money into. He was right.

Even so, when Montecatini's struggling production required still more money, he went to the U.S. for it. Wall Street was not interested—a fortunate circumstance, as it turned out, for Montecatini never again had to offer so much for so little in return. Back in Milan, Faina took a deep breath—and this time tripled. In May, 1947, the number of shares outstanding was raised from 40 million to 120 million. That was bad enough, but seven months later, in November . . . The general meeting called to discuss his decision to double the number of shares again was a riotous one. The stockholders, he recalled recently, "were wild," as well they might be over such a drastic dilution of equity. (In Italy, two maxims disturb the investor at the very onset: the first is the simile "stupid as a shareholder," the second, "business is other people's money.") Some shouted, "You're squeezing money out of us all the time." But Faina, combining the probity of a Vatican diplomat with the *sangfroid* of a Mississippi River gambler, was still equal to the situation. "I just told them we needed their money, we have so much to do." Happily, with that issue and a subsequent stock consolidation, Montecatini was over the hump. "Good times" had begun again in Italy and important new discoveries of natural gas had been made in the Po Valley. These would permit an Italian petrochemical company to hold its own against once overpowering competition, the German and French companies with their cheap coal. There was, however, no relaxation around Palazzo Montecatini; effort simply shifted from reconstruction to development.

Development, of course, was quite a different kettle of fish. Up until that time, Montecatini men had been turning their excellent technical training and immense capacity for work into re-creating the company in its prewar image. That was what Faina wanted, as far as it went, but he looked upon the restoration of a productive base as only a preliminary. To take the company forward in the postwar atmosphere of intense competition and vaulting technology would require new kinds of production and, most important, a new kind of mentality.

$200 Million Worth of Prescience

Part of that new mentality would have to be technical. Somebody was needed with the vision to foresee trends in the chemical industry, and the nerve to back up his prescience with a couple of hundred million dollars. Montecatini had a potential petrochemical-division head in Giulio Ballabio, a broad-gauge expert in the field, and in Bartolomeo Orsoni, the kinetic chief of the nitrogen division, just the sort of driving executive needed to elaborate research into development. But for the really top spot, a managing director alongside Faina, there was only one logical choice, Piero Giustiniani. An engineer metamorphosed into an executive, Giustiniani was the kind of management man American companies run to sign up. As bold as Faina was subtly effective, he had also been a protégé of Donegani and indeed was fired from Montecatini ("for Fascism") at the same time. All would depend, however, on whether the political climate had changed enough to permit his return.

It must have taken plenty of political pull to slip Giustiniani back into the company, but Montecatini had it in some of its political supernumeraries, principally Chairman Giuseppe Mazzini, who held a seat in the Italian Senate. With Giustiniani to handle the technical side and Faina giving full time to his specialties, policy, politics, and finance, the company became what it is today, a sort of duumvirate. ("If those two men could be sewed together," remarked an old company hand recently, "you'd have the perfect leader.")

Giustiniani went to work at once on a five-year development plan—itself significant of the change at Montecatini, because in hand-to-mouth Italy long-range planning is virtually nonexistent. His main intention was to expand nitrogen production from 120,000 to 300,000 tons by 1955, mostly using the new Po Valley natural gas, and make a big push into plastics via petrochemicals. ("Petrochemicals are interesting in their flexibility of production; you can push one and hold another in reserve for next time.") There was nothing to guide him in the plastics field, however, for the material was still a relatively unknown quantity in Italy, so output of olefinic bases (ethylene and propylene) and their products, polyethylene and polystyrene, was figured on a one to thirty ratio with the U.S. This resulted in a total plastics production of 50,000 tons in 1955. Over all, Montecatini's first five-year plan (1949–54) more than doubled its productive capacity, mineral output rising 20 per cent, chemicals 166 per cent, electric power 114 per cent.

Such a monumental performance was naturally attended by a full complement of problems. For one, Montecatini was forced into the manufacture and sale of stockings before it could convince Italian manufacturers there was a market for its nylon yarn. Then Edison of Italy, the nation's third-biggest company, got into the production of nitrogen. "How could I have foreseen," growled Giustiniani, "that Edison, an electric company, would go into nitrogen?" Rather than compete head on with Edison's cheap power, Montecatini had to let the newcomer help itself to a generous portion of the expanding market for this material. But Edison was not content with a 15 to 16 per cent cut of Italy's nitrogen sales; it pushed on into polyvinyl chloride and there not only made a place for itself in the market but, as in nitrogen, brought the price tumbling down.

Within the new plants themselves, Giustiniani had trouble getting Italian labor to understand the essentiality of teamwork and precision. At the Rhodiatoce nylon factory, a joint venture with Rhodia Française, the management had finally trained a ragtag collection of Neapolitan barbers, artisans, small farmers, and tradesmen in carrying out the nylon process, but then their native individualism began to reassert itself. Thus a workman whose job it was to measure the denier of the thread with a delicate apparatus was discovered doing it by eye. Moreover, he kept right on, insisting that his personal judgment was far superior to any mechanical gadget. "Such an intellect," wryly observed the plant manager, "had no place in a mere factory."

Another southern plant produced an even stranger reaction to the Giustiniani drive for technological ascendancy. There a Communist labor leader declared that the new nitrogen process had impaired his sexual potency. Moreover, in the midst of the general uproar, he offered to have his wife examined to prove it. Scientific arguments were unavailing but a raise in wages was, and the men uneasily went back to work. A day or so later the Communist encountered Montecatini's negotiator in a neighboring town and over a trucial bottle of wine the matter of impotence was put in its proper perspective. "We're both away from home," began the Communist with a look as old as Adam, "and I know where there's a couple girls . . ."

The Making of a Mentality

At the same time that Piero Giustiniani was fashioning a new productive base for the company, its human resources were undergoing an equally rugged alteration. To resolve Montecatini's labor-management problems—and establish the New Mentality—two bright young men were brought in from outside: Gino Sferza, an ex-Socialist, and Riccardo Riccardi, a onetime Communist labor leader who had broken with the Italian C.P. over Russian control. The trouble with Montecatini executives, as Sferza and Riccardi quickly discovered, could be divided into two main categories. First, there was that "lost generation" of management, a gap created by the war and by Montecatini's lack of internal competition, common to autocracies. How bad the situation was in 1950 can be surmised by the situation today, when the average age of Montecatini's top-level personnel is fifty-five; beneath them is a very promising group of young men, averaging thirty-five years of age, the lowest management echelon; but between the two there is only the thinnest middle group: no more than 10 per cent of Montecatini's executives and executives-to-be are in their forties.

Second, Donegani's authoritarianism had long ago destroyed initiative at Montecatini. Many company executives were scared to death of assuming anything but routine responsibility. The plant managers were little more than messenger boys, technically competent, but otherwise putting their faith in the panacean phrase: "I will call Milan." In essence, a good chunk of management had simply forgotten how to think, since Donegani had always done it for them, and even when the Great Man was no longer stalking through the Palazzo corridors, his picture glared down from their walls as if to say: "Don't try to change this man, he was made by *me*, Donegani!"

The ironic aspect of the whole situation was that even though Faina and Giustiniani made it plain they intended to "force" decentralization on their subordinates, many executives were still leery of more responsibility. This reluctance (which still exists) was recently explained by Riccardi as the Italian's historical sense of insecurity: "If an executive is conditioned all his life not to say what he thinks and then at age forty the boss says to him, 'Be yourself, say what you think'—the man looks on the invitation as some kind of trick. His first reaction is mistrust; he thinks: 'The boss is trying to get me to put a rope around my neck—that's why he's talking to me this way.' "

Sferza, however, believed in the sink-or-swim philosophy of development and forthwith threw the plant managers into the broad ocean of individual responsibility. Each, for example, was given a special fund to be used in any way he wanted—awards, bonuses, raises—to stimulate production and morale among the workers. Six months later Sferza called for an accounting: not a lira had been spent. A paraphrase of the reasons: "*Good* plant managers don't spend money, they save it; besides, figuring out which workers ought to be rewarded is too much of a responsibility." But Sferza kept right on prodding them into deeper and deeper water, pausing only to pump out an obviously drowning executive.

The next step in the remolding of Montecatini's management was production of a detailed organization chart of the company, the first in Montecatini's history. Using the most advanced American methods, Sferza and Riccardi streamlined existing jobs and added new ones, among them a category to develop operating management. Indeed the Americanization of Montecatini even went so far that "purely American techniques" were adapted for Montecatini in three key manuals on leadership and teamwork. Yet here again the difficulty was getting people to accept the changes. Some of the division chiefs, like flabby old wrestlers, simply used their deadweight to bring each innovation thudding to the ground. It has taken almost four years of Sferza and Riccardi to win acceptance of their new lines of promotion and responsibility. Phase two, getting these new lines actually to work, has just begun. Though the battle continues with some division chiefs and plant managers, Montecatini can now claim, with justification, that its plant managers have more autonomy than those of any other corporation in Italy.

Getting labor to change its embittered Marxist viewpoint was just as big a problem, particularly the way Faina wanted it done. Where Italian industry actually cared—and at first a large sector didn't—management was divided into two groups on the Communist question. One made no effort to find why the workers went over to the C.G.I.L., the Red union, treating Communism as a purely political force whose adherents became automatically unemployable. The other group, a minute fraction of the whole, was convinced that the power at the top of C.G.I.L. was a direct consequence of the ferment below, and that only by identifying and correcting the causes of that ferment could the Red ties be broken. This was to be Montecatini's approach.

The Battle Begins

The initial phase of the company's anti-Communist drive was concerned with use of the stick rather than the carrot. Sferza believed that of the 83 per cent of Montecatini workers who were then (1950) members of the C.G.I.L., no more than one-fifth were hard-core Communists. And the reasons the fellow traveling four-fifths had signed up with the Red union were (1) they believed only the Communists had the workers' welfare at heart, (2) fed up with Italy's chronic unemployment, they wanted job security and thought Italy's Communist party, the biggest in Western Europe, could get it for them, (3) fear. They were afraid of being beaten up if they didn't strike when the Communists told them to and they believed that all in all it was safer to be Communist. Indeed there was an ominous joke going the rounds that it was far better to be a Red captured by the Americans in any war between the U.S. and Russia than an anti-Communist captured by the Soviets.

To alleviate this fear, Montecatini put the C.G.I.L. on notice that it would protect all employees who refused to take part in a *political* strike and would sack any Communist who tried to intimidate his fellow workers. A hundred Red leaders were fired as troublemakers the first year. Political strikes—daylong nuisance affairs called on such occasions as the Rosenberg trials, General Ridgway's visit to Rome, Italy's entrance into NATO—virtually ceased. The C.G.I.L. then tried "non-collaboration." Non-collaboration turned out to be a strike without striking: there were slowdowns and work stoppages for ten minutes out of every hour all day long, with nobody leaving the plants. Montecatini took the lead in getting a new interpretation of labor law that made trespassers of those workers who remained in a factory but refused to work. It also organized special squads of loyal workers to run any plants shut down by political strikes, paying the squad men extra bonuses. Non-collaboration ended with 1953—and 1953 was the year the Italian Communist party polled a whopping 6,100,000 votes.

Recompense versus Martyrdom

The carrot phase of Montecatini's strategy for breaking the C.G.I.L. centered on offering loyal workers tangible benefits while denying them to active Reds. Though nobody would be fired for being a Communist—"we weren't going to make any martyrs"—neither would he be promoted. Special company benefits would be withheld from Communists while those to loyal workers were enlarged. Some of the benefits: 5,000 employees a year were given vocational-training courses to prepare them for better jobs; every year 5,600 children of employees became eligible for a month in a vacation home, completely free; 2,000 workers each year were sent to the company's plush resort hotel near Naples for a free two-week vacation. Quarters at moderate rents were available in the 8,000 company-built houses and so were loans at low interest rates. In the Reddest area, the Tuscan mines, where a closed-in society had practically no form of social intercourse save Communist meetings, excursions were organized for miners and their families to show them what the outside world looked like. And finally, lest Montecatini's anti-C.G.I.L. crusade be set down as anti-unionism, local collective bargaining was actively encouraged.

Under this two-pronged assault the "free unions"—the C.I.S.L. (Christian Democratic) and the U.I.L. (Social Democratic)—grew stronger while C.G.I.L. membership declined drastically. The proportion of Montecatini workers in the C.G.I.L. dropped to 40 per cent this winter, a 50 per cent reduction in six years, well below the 50 to 55 per cent of all Italian industry. The C.G.I.L. has practically no members in the new petrochemical plants, while the Red tide has even receded in Montecatini's Tuscan mines. These mines, then 98 per cent Communist, were struck 221 times during 1952. In 1955 the C.G.I.L. roll had dropped to 50-odd per cent and the number of strikes to less than ten.

That 40 per cent of all company workers still retain their membership in the C.G.I.L. may suggest to Americans that Montecatini's job is only half done. This is true. The unhappy fact, however, is that Communism in Italy as in France is not something which industry alone can successfully eliminate. It is not just an industrial but a political force, as witness the fact that the Communist party is represented in the Italian Parliament by fifty-four Senators and 143 Deputies (the total for all parties: 237 Senators and 590 Deputies). Consequently many industrialists believe that if they can reduce Communist representation in their plants to 30 or 35 per cent of the working force they will have just about hit rock bottom. Montecatini is pressing toward that goal. To go beyond it and really bring Communism under control will require not just a revolution in management techniques but a revolution in the political thinking of the Italian people.

Today, after twelve years of unremitting effort, a bill of particulars on Montecatini makes an impressive contrast with the one that summarized its plight in 1945. Instead of labor anarchy, there's the beginning of industrial democracy. Productivity, so difficult to increase in a land where the overmanning of jobs is still a political requisite, has taken a jump. Company loyalty, a new experience for many Italians, is now a dependable force. Indeed, the rise in Montecatini's profits (up from 1955's $16 million to $17,300,000 in 1956) at a time when those of most American chemical companies were declining was attributed by Count Faina to just one thing: an absence of strikes. Instead of 1945's managerial timidity, Montecatini is now one of the best-run companies in Europe. Pressure from the top, from Faina and Giustiniani, is gradually forcing the remaining Old Mentality Men into acceptance of decentralization—or retirement.

A Matter of Molecules

In other critical areas, Montecatini's research, if largely derivative like much of that in Italy, is very good indeed, well financed and broadly planned. The company is on the verge of pilot-plant operation for a new kind of chemical rubber. It is also preparing to build a factory in the U.S.—probably in the Ohio Valley—to make one or more of the isotactic plastics exclusively developed for it by Professor Giulio Natta of Milan. Isotactics are the result of a new concept of molecular symmetry and, in a practical application, make possible very hard plastics able to withstand heat of 600° Fahrenheit. The company has already made a profitable thing of licensing the Fauser nitrogen patents;* additional earnings should be forthcoming from isotactics. Altogether, Montecatini's "expectation" is that over 1 per cent of its 7 per cent profit on sales may come from selling patent rights.

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* Giacomo Fauser, now a Montecatini vice chairman, had been spotted by Donegani back in the early Twenties—an impecunious scientist developing a brilliant new synthetic-nitrogen process in an old cannon salvaged from World War I. Fauser's subsequent patents gave him worldwide recognition and much enriched the company when Donegani, greatly daring, built four highly profitable plants around them.

Financially, Montecatini is in the quaint position of sometimes being the victim of its own success. The company's stock is both the most actively traded in Italy and the most widely held (its 100 million shares are owned by over 200,000 shareholders). Moreover, if the stock's listing on the Big Board has a typical effect, American purchases of the shares will further stimulate Italian buying. This would result in an unwanted increase of share prices at a time when Montecatini's price-earnings ratio is already high (24.2 to 1), more than twice that of Britain's Imperial Chemical Industries. Indeed, among comparable U.S. chemical companies, which have the undeniable advantage of being on this side of the Atlantic, Montecatini's ratio is higher than Allied Chemical's 20.5 and du Pont's 23.3, though lower than Hercules Powder (25.1) or Union Carbide (26.4).* Yet one factor in the high price-earnings ratio is reassuring: earnings appear lower than they actually are both because Montecatini probably understated them by as much as 15 per cent and because the company wanted to write off its $200-million postwar reconstruction almost as it went along. Today it has the freedom of plants 60.2 per cent depreciated, only seven-tenths of a point below the du Pont figure. But perhaps its most comforting financial statistic is an average profit margin for the past three years (including profits on capital construction executed itself for its own account) of 35.6 per cent—close to the 36.17 per cent average of the American phenomenon, du Pont.

Financial strength is a direct reflection of competitive strength, and here too the company is more muscular than ever. Domestically, it has the tremendous advantages of integration, size, dispersion, agility, and of being a pioneering enterprise. In petrochemicals, Montecatini is considered to be at least two years ahead of any possible Italian competitor and the company plainly intends to keep it that way. (So far $35 million has been earmarked for five new facilities at Ferrara and Novara.) In agricultural chemicals, where unnatural competitors like the government-owned E.N.I. promise nothing but trouble, Montecatini is prudently withdrawing to throw greater strength into other fields. Agricultural chemicals, currently 40 per cent of the company's over-all production, are scheduled to drop to 30 per cent by 1962; at the same time, industrial chemicals and plastics-and-related products will rise from the present 30 per cent each to 35 per cent each.

Montecatini's competitive vigor, of course, is meaningful only if the Italian economy also remains vigorous. With 80 per cent of company sales dependent upon the domestic market, stagnation in Italy could deal a body blow to its Chosen Instrument. The company, moreover, is banking that a continued high rate of national growth will make possible development of the potentially important southern markets—now a depressed region where live two-fifths of Italy's population.

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* Yields at 3.9 per cent put Montecatini well ahead of Union Carbide (2.3), the lowest of the four U.S. comparables, and Allied Chemical (2.7), the highest.

An Unwelcome Blueprint

Equally critical for Montecatini, of course, is how Italy chooses to go about its economic expansion. In a recent conversation Count Faina spoke with guarded approval of the much discussed Vanoni Plan for Italy's development. At the same time he made it abundantly clear that his endorsement of this ten-year plan is only as a sort of goal, an expression of Italian aspirations; he would be most uneasy if Italian Socialists were able to transform it into an economic blueprint under which the government tried to plan and control Italian production. Whatever Montecatini may have gained in the distant past through "collaboration" with the state, its present philosophy points in just the opposite direction. What Montecatini's management hopes is that as time goes on there will be a relaxation, not a multiplication, of government price controls and the other anachronisms that still clutter up the Italian scene.

Given the present complexion of politics in Italy, this may be a vain hope, especially since Montecatini itself is under continuous attack from the Left as a vast monopoly, which its critics think must be checked by statist measures. Partly as the result of this, but basically because the company is simply too big for Italy, it has been increasingly looking for markets abroad. Today 20 per cent of its sales flow beyond Italy's borders, chiefly to the eastern Mediterranean, the Far East, and the Americas. Count Faina is confident of holding this position and maybe bettering it. Since 1949, when Italy began liberalizing its import restrictions, the company has had to meet the stiffest kind of foreign competition at home. Now, with the development of Europe's common market, it should enjoy elsewhere the unimpeded entry its competitors have so long enjoyed in Italy. Montecatini's selling methods, with their emphasis on service and technical knowledge, have been honed to razor sharpness for just such an eventuality. Completely reorganized by a fireball named Giovanni Lombardo, head of one of the three sales divisions, the company's sales techniques would be a credit to any top chemical outfit, European or American. As for Montecatini's strength in the U.S. market, it is undoubtedly true that the company has something to learn about price and quality, but the significant fact is that when its polyvinyl chloride was selling for 17 cents a pound in Italy, our domestic price was 38 cents. And even after Montecatini's selling of several million pounds helped bring the price down to 27 cents, the Milanese giant could still cross an ocean and make money at that figure.

Safety in Speed

Patently the world will find Montecatini more on its doorstep than ever before. This perhaps accounts for the fact that with a world to win, Italy's Chosen Instrument is wasting no time congratulating itself on its achievements at home. "The company is in a transitional period," said one of its New Mentality Men, with the candor of the breed, "and any transitional period is dangerous. Montecatini has only one chance: to develop very fast. Faina gives me the feeling that things are going on, slowly maybe, but with a clear idea ahead. If he and Giustiniani push their policies as in the past, the difficult period should be over in the next two years." And what does Faina say? "In the past six years Montecatini's sales went up $64 million; we should show a similar gain in the next five. That means $300 million for Montecatini in 1962 and about $500 million for the company and its affiliates." Yet even as he talked, the incoming figures for 1956, taking an unexpected jump to $240 million in sales, had made his projections unduly modest.

The vibration around Palazzo Montecatini is caused not only by "the little train with the wooden leg." The real shaking of the ground comes from the dynamism of a great company getting ready to outdo itself.

It must be borne in mind that growth in sales, of itself, cannot be considered to be a valid corporate objective. Without a concomitant growth of profits a firm's sales expansion becomes a fruitless waste of energy.

Union Carbide Corporation has been singularly successful in achieving increased profits together with increased sales; in fact, the profits have risen more than the sales. How has Carbide done this? What criteria does this firm use to select growth areas? How has Carbide financed this growth? These, *and other questions are raised and answered in the accompanying* selection. It shows that an important part of Carbide's strategy has been to ignore areas where it cannot achieve a very strong position on the basis of raw material availability, market, process, etc., or some combination of these basic factors. The article also probes deeply into the company's basic operational philosophies, singling out salient characteristics for analysis. The result is an article that presents a fascinating record of how the big get bigger—and make it pay.

17 Union Carbide Enriches the Formula

by Dero A. Saunders

Union Carbide & Carbon Corp., which had record sales of $1.3 billion in 1956, is the second-largest chemical company in the U.S., as well as the No. 1 producer of plastics, of calcium carbide, of carbon electrodes, and of such key industrial raw materials as ferroalloys, oxygen, and tungsten. But because Carbide turns out only three consumer products—Prestone antifreeze, Eveready flashlights and batteries, and Pyrofax bottled gas—it is probably the least-known giant corporation in American industry. This obscurity is only partly a result of the nature of its business. For years Carbide's conservative management assiduously

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courted anonymity, and even today Carbide's sixty-one-year-old President Morse G. Dial can hardly be accused of headline grabbing. Thus to the casual observer—or even investor—Carbide appears to remain what it has long been: a taciturn, unchanging "chemist to the chemical industry and metallurgist to the metal industry," as one of its own executives puts it.

But the appearance of changelessness is misleading. Actually, Carbide has grown enormously in the postwar years. It increased its sales of chemicals and plastics, for example, from $172 million in 1946 to some $610 million in 1956—about 255 per cent—a considerably sharper rise than that scored by top-ranking du Pont (185 per cent) or the third-ranking chemical company, Allied (138 per cent). To be sure, slightly more than half of Carbide's volume is in such non-chemical fields as ferroalloys, carbon, and atmospheric gases, which have not shown the chemical industry's capacity for explosive growth in the last decade. But even if its chemical and non-chemical sales are lumped together, Carbide's across-the-board sales gain of some 213 per cent is exceeded among the major chemical companies only by Dow and Monsanto—both of which started from much lower sales bases than Carbide.

And there are at least three intriguing signs of change beneath the placid surface. Scarcely a month ago Carbide's management parted with $99,400,000 worth of Carbide stock to buy the Visking Corp. of Chicago, a maker of sausage casings and polyethylene film—the first shift of the company's basic strategy in the direction of end-product manufacture. Carbide is also engaged in a reorganization of its research program, one of the nation's largest. And at Carbide's headquarters in Manhattan, Dial, chief executive since 1952, is about midway through a quiet but significant reshaping of the company's management structure.

The auguries for the future are for further change—and growth. U.S. output of petrochemicals, for example, has roughly doubled every five years since the end of World War II and is expected to double again by 1960 or 1961—and Carbide is the top producer of petrochemicals. Carbide's Linde Air Products Co. (Carbide calls a division a company) expects to sell twice as much oxygen this year as it did as recently as 1955, for steel mills are finding it cheaper to raise the output of open-hearth furnaces by the massive use of oxygen than to build new capacity from scratch. Carbide's Electro Metallurgical Co. (Electromet), already the largest U.S. producer of titanium as well as of ferroalloys, expects the now rare metal tantalum to become a major new product. And the prospects for brand-new plastics are so bright that Carbide executives hint guardedly at the possibility of a major breakthrough by 1959.

The Hidden Pocket

Compared to Carbide's sparkling sales performance, its postwar profit record, at first glance, appears surprisingly drab. To be sure, after-tax earnings went up from $57 million in 1946 to some $147 million last year, net per share (adjusted for a 1948 stock split) from $2.03 to about $4.90, and dividends from $1 to $3.15. However, Carbide's after-tax earnings last year were less than two and a half times the level of 1946, while its sales had more than tripled. Even Carbide's before-tax return on sales was about the same as in 1946—22 per cent; and its pre-tax earnings on invested capital actually declined from 26 per cent to 25 per cent.

This apparently poor profit showing is largely illusory, however, for it reflects almost entirely a conservative write-off policy. The company's depreciation account has risen more than 600 per cent since 1946—from less than $15 million a year to nearly $115 million. Two factors explain Carbide's ability to take such massive write-offs. First, some $300 million of the company's postwar construction spending—nearly half the total amount spent over the past five years—was covered by rapid-amortization certificates. Thus Carbide's excess over normal depreciation was some $32 million in 1955 and again in 1956. And second, Carbide swelled its normal depreciation charges by adopting the "sum of the digits" method of depreciation, which allows two-thirds of a facility's capital cost to be amortized during the first half of its life. The combined effect of both factors was to understate 1956 pre-tax earnings by about $35 million, or 11 per cent.

The most sensible measure of Carbide's profit record would seem to be its pre-tax, pre-depreciation earnings. These have risen 270 per cent since 1946 (as compared with a 213 per cent increase in sales volume). They are now running about 31 per cent of sales compared to 25 per cent a decade ago. Measured against the top six U.S. chemical companies—in order of size, du Pont, Carbide, Allied, Monsanto, Dow, and American Cyanamid—Carbide's 1955 ratio was somewhat lower than that of du Pont and Dow (37 and 35 per cent respectively), but considerably above the ratio for Allied, Monsanto, or American Cyanamid.

One Hand Washes the Other

"What is the key to this corporation?" Howard S. Bunn, Carbide's executive vice president for operations, gives this summary answer: "We are equipped with a vast number of skills in research, technology, engineering, and development. No other corporation on earth has the *com-*

bined skills that we have—though others have some skills that we don't. Du Pont, for example, can run rings around us in textile fibers. We do best by getting into a basic item and sticking with it, where our combined skills can come into play."

That interplay of skills has characterized Carbide ever since 1917, when five companies—a maker of calcium carbide, an acetylene distributor, an electrode manufacturer, an alloy producer, and an oxygen distiller—merged to form the company. A single example will illustrate Carbide's ability to create, by cross-fertilization among its components, entirely new products. Polyethylene (the squeeze-bottle plastic), which has become Carbide's most important single product, with annual sales already near the $100-million mark, was discovered before World War II by Britain's Imperial Chemical Industries. During the war the patent was licensed to both du Pont and Carbide (see "The Polyethylene Gamble," FORTUNE, February, 1954), but production proved formidable. To start with, the ethylene raw material had to be extremely pure, which required its fractional distillation at temperatures so low that equipment made of ordinary metals became unpredictably brittle. Then the ethylene had to be put under the fantastic pressure of 30,000 pounds while cooling tubes removed the heat of compression. Carbide's early attempts at polyethylene output yielded a pound of scrap steel—in the form of broken apparatus—for every six pounds of polyethylene.

But Carbide's chemical division could seek help from the Linde division's experts, accustomed to working with temperatures as low as that of liquid helium, and from Electromet, which know the alloys most likely to withstand any given combination of temperatures and pressures. Linde's research on synthetic diamonds (it is the largest U.S. producer of synthetic gems) had involved experimental pressures up to 100,000 pounds. This intramural cooperation enabled Carbide, working alone, to do a better job on polyethylene production than du Pont could do with I.C.I.'s assistance. As a result, Carbide supplied the top-priority war needs for polyethylene, and established an early post-war production lead over du Pont. And Carbide has kept that lead by increasing its domestic polyethylene capacity to 250 million pounds, some 40 per cent of the industry's current capacity of approximately 600 million pounds.

What Carbide Makes

Chemicals **accounted for nearly 30 per cent of Carbide's $1.3-billion sales last year. Some 400 products (100 in tank-car volume) are made at seven major plants by Carbide & Carbon Chemicals Co. Most are petrochemicals, a field that Carbide opened up thirty years ago and still dominates.**

Plastics, made by Bakelite Co., account for 17 per cent of total sales. Carbide sells about 40 per cent of the two most important plastics—vinyl (shower curtains, floor tiles, etc.) and polyethylene, the squeeze-bottle plastic.

Alloys and metals, which account for 26 per cent of Carbide sales, are produced by Electro Metallurgical Co. (Electromet), top U.S. supplier of ferroalloys such as chrome, silicon, manganese, and by Haynes Stellite Co. With a new 7,500-ton Ashtabula, Ohio, titanium plant reaching full production, Electromet is also the biggest U.S. titanium producer.

Gases, produced by Linde Air Products Co., account for 15 per cent of sales. Carbide is the No. 1 producer of acetylene (made from calcium carbide produced by Electromet) and oxygen. Linde is currently building new oxygen plants to meet the steel industry's vast new oxygen demands.

Carbon, which accounts for about 12 per cent of sales, is the preserve of National Carbon Co., the leading U.S. producer of electrodes, refractory carbon (i.e., bricks, pipes, etc.), and flashlights and batteries (Eveready brand). As Carbide's major channel to the consumer, National also distributes Prestone anti-freeze for the chemical division.

Miscellaneous: Carbide is the No. 1 operator of atomic-energy plants (it runs three for the AEC plus the Oak Ridge laboratory); a leading producer of uranium; the largest U.S. producer of tungsten; the foremost U.S. distributor of bottled gas; and a major supplier of vanadium.

The recent appearance of two low-pressure polyethylene processes, one devised by Germany's Dr. Karl Ziegler and the other by Phillips Petroleum, has raised the number of entrants in the Great Polyethylene Derby to eleven. Carbide itself is buying into the low-pressure field by building two plants, one of each type. However, Carbide executives insist that the original high-pressure product will be as suitable as the low-pressure for most end uses and perhaps superior for some (such as plastic film)—while costing, in Carbide's case, a little less to produce.

Unfair Advantage

Besides being a complex of neatly interrelated technological skills, Carbide has always been primarily a processor of the fundamental stuffs of earth—coke, limestone, ores, natural gas, air—into raw materials for someone else's manufacture. "Basically," says President Dial, "we are a raw-materials supplier to industry. Our problem is how far along we are going to carry our products. We have always moved toward more complex materials, but we hesitate to do something that someone else can do."

Before entering a new market, Carbide has always sought some clear edge in either raw-material supply or production process. Lacking such an edge, it hesitates to launch products that might seem to complement perfectly the company's existing lines. Consider these areas that Carbide might have entered and did not:

Nickel and molybdenum production would complement Electromet's present alloy business, but Carbide was never successful in getting adequate and economical ore supplies.

Urea and melamine plastics (whose uses range from textile finishes to unbreakable dishes) would round out the company's plastics line nicely, but Carbide has avoided both markets because American Cyanamid and others got there first. On the other hand, Carbide has pushed boldly into the tough new epoxy resins despite a strong position held by Shell and Devoe & Raynolds. Reason: these companies are interested in epoxy coatings, while Carbide is concentrating on the use of epoxies in molded form (e.g., in dies).

Synthetic rubber failed to tempt Carbide, despite the company's wartime experience producing butadiene, the major rubber raw material, for two reasons: Carbide's butadiene process was inherently costly; and the bulk of synthetic rubber was used by tire companies, which would, Carbide's management reasoned, demand a low price for synthetic in order to hold down natural-rubber prices. Vice President Bunn admits that "we would have jumped in if we could have come up with a better specialty rubber," such as du Pont's Neoprene—but Carbide never hit on the right one.

Pharmaceuticals have been ignored because, in Bunn's words, "they are simply not our kettle of fish. Biochemical and clinical research is entirely different from anything we do. It's better to exploit our own technology."

Synthetic fibers have been a Carbide interest for twenty-five years, but the company's only marketed fiber to date—Dynel—is still poking along at a minuscule six-million-pound annual rate, instead of the minimum 30 million to 50 million pounds that a successful synthetic fiber must sell. In fact, Carbide makes more money from the acrylonitrile that it furnishes to du Pont (for making Orlon) than from its own output of Dynel.

Nevertheless, Carbide will jump into a field pioneered by others *provided* it has a strong raw-materials position or a potentially superior technique. In polyethylene the company had both. As for titanium, Dr. Wilhelm J. Kroll, inventor of the standard titanium-reduction process, worked for Carbide during World War II, and Carbide could have gone into titanium long ago using the Kroll process. But not until it had perfected in 1953 its own new and lower-cost reduction process (employing sodium) was Carbide willing to take the plunge—several years after other companies had begun production. In silicones, however, Carbide expected to have a clear product advantage for its new silicone division, which was split off from Linde Air Products last year. But when it was too late to turn back, a group of silicone specialties that looked quite promising failed to pan out. Therefore Carbide must compete with more experienced G.E. and Dow Corning on standard silicone compounds, without benefit of what one executive called the prime ingredient of a new Carbide product —"an unfair advantage."

The Sausage Game

The Visking purchase represents a different sort of attempt to gain an advantage, in this case by taking manufacture nearer to the final-product stage. Du Pont's profit figures have long demonstrated that finished chemical specialties usually carry the plumpest margins—which was one reason Carbide laid out $99,400,000 worth of stock for Visking, whose depreciated book value was only $34 million. The day the purchase was announced last September, Carbide's common stock broke three points, from 118 to 115. But Visking was earning over $5 million on $60 million of annual sales, a fact that helped Carbide executives endure both the gibes of their friends ("Hear you fellows have gone into the sausage game") and the implied reproof of investors at the nominal dilution of equity.

Visking absorbs some 40 million pounds of polyethylene annually, but that was one of the less important reasons for the purchase; Carbide was engaged in nothing so simple as buying up volume. Rather, by making finished polyethylene film (though not the articles fabricated from the film) instead of raw polyethylene alone, Carbide is attempting to guarantee the health and continued growth of a product on which it has already bet, in plants built and building both here and abroad, over $100 million. "We bought Visking," says Bunn, "because we thought the film field in general had enormous potential, which could be developed better by us than by anybody else." And Visking's position as a supplier to the meat and food industries will give Carbide access to major new markets, all of which would bring the company closer to the consumer than it is today.

Toward the Unknown

As Carbide moves gradually toward the consumer in the manufacture of its products, its research seems headed in precisely the opposite direction. Carbide has never skimped on research: its 1956 research and development outlay of $47 million represents as high a percentage of sales (nearly 4 per cent) as is spent by any major U.S. industrial company except General Electric (6 per cent). Only a small portion of Carbide's research could be considered basic research, however; by far the largest portion goes into product and process development.

Coal hydrogenation, on which Carbide has already spent some 25 million over the past two decades, is the kind of project that Carbide has always excelled at. As a chemical concept, coal hydrogenation is relatively old: it involves mixing powdered coal with a little oil and hydrogen, and then gently cracking the mixture with heat and pressure into a loblolly of chemicals quite different from petrochemicals. German hydrogenation efforts before and during World War II were aimed primarily at producing gasoline from coal. Carbide, by contrast, is seeking a new cheap way to make chemicals from an abundant raw material, as insurance against the day when the depletion of West Virginia's natural-gas reserves might leave Carbide's great chemical plants at South Charleston and Institute, West Virginia, starved for raw materials.

Developing a practical hydrogenation process has turned out to be a "long, hard, and bitter battle," as one vice president put it, though recently there has been real progress. For example, last year Carbide was able to convert its $11-million hydrogenation pilot plant to the manufacture of conventional chemicals, having learned enough about the new art so that a much smaller pilot plant now suffices. And art it is, for the simultaneous use of pressures up to 10,000 pounds and temperatures up to 1,250° is unknown, on a production scale, anywhere else in the chemical industry.

However, even if coal hydrogenation succeeds, it will be a triumph of process engineering rather than of research. The fact is that Carbide has not had a major research triumph since it opened the petrochemical field some thirty years ago. Since then nothing has come out of Carbide's laboratories to match du Pont's brilliant (and lucky) nylon discovery. That coup began with fundamental high-polymer research, and concluded with a feverish hunt for raw materials to make an end product already in hand. Carbide has always worked the other way, from a known raw material toward an unknown end product; and Carbide looks its best when that end product—like polyethylene—proves both widely useful and exceedingly difficult to make.

Carbide's historic bias toward developmental research has been accentuated by the fact that each of its research laboratories is attached to a particular operating division. Dr. Augustus B. Kinzel, who became research vice president in 1955 after twenty-eight years in Carbide labs, is seeking to escape the penalties of too much fragmentation by guiding the over-all course of research, setting up interlab committees, and giving the divisional labs special funds ($4 million last year) to be spent on projects chosen by the head office instead of by the division. Nevertheless, Carbide has suffered from the researcher's understandable inclination to concentrate on those projects that promise his division an early product payoff.

How thoroughly Carbide is reappraising its research pattern may be judged from these recent events: (1) last June Carbide announced plans for a new basic-research center to be built on a 280-acre site in New York's Westchester County; (2) construction has already begun on a new Carbide nuclear research lab, with experimental atomic pile, some forty miles from Manhattan in Orange County; and (3) last September Carbide opened a new $6-million lab for research in solid-state physics at Parma, Ohio. The first of these laboratories will be under central management control; the second and third, though run respectively by the nuclear and carbon divisions, will obviously range much more widely in their investigations than the present field of interest of either division.

Thus President Dial hopes to avoid the temptation for Carbide researchers to "get so interested in their projects that they become specialists—they want to follow them out of the lab into sales." But Carbide's moves are also indicative of a larger change that is beginning to appear in all corporate research. Most of the easier research plums have been plucked; henceforth corporations will have to start further back in the chain of knowledge, and spend more time and money, if their research is to be profitable.

The Advisory Boss

Compared to the wide publicity given Carbide's new research plans, the company's recent management changes have been wrought so quietly as to seem almost stealthy. The major problem was to get a little centralization into a traditionally decentralized enterprise. For all their willingness to rescue one another's hot chestnuts, Carbide's operating divisions had always bought different raw materials, had different production problems, sold to different customers in different markets, and in general maintained a resolute independence. (It has only recently become standard practice for the National Carbon Co.'s consumer products, for example, to admit even in small lettering that National Carbon is a division of Union Carbide.) "Essentially," says Dial, "we have been a holding company"—literally so until 1950, when the parent company absorbed the major operating subsidiaries. And the persistence of the old nomenclature, with the divisions called "companies" and their heads called "presidents," reveals that divisional autonomy, while declining, is still great.

The management changes, most of which have occurred since Dial became executive vice president in 1951, have had to do partly with executive development and partly with divisional organization, but most importantly with the central corporate structure itself. While most members of Carbide's management corps joined the company during the first or second world war, continued hiring by the expanding chemical division in the depression left Carbide with less of an executive age-gap problem than many companies have. Rather, Carbide's problem was how to give its executives broad company experience and outlook, despite a highly divisionalized operating setup. The problem has been tackled by encouraging interdivisional executive transfers wherever possible, and by adding a second executive vice president (the first was in charge of operations) to build up central staff functions—e.g., industrial relations and long-range planning. The head office has also recommended—Dial is careful to use the mild word—that the divisions change their traditional production-sales-research structure in favor of vertical integration within product groups, with a single department head responsible for his group from research through sales.

At the center, a new kind of committee rule for Carbide has begun to appear. The major function of the head office in years gone by was to dole out money to the divisions. The corporate purse strings were held by an eight-man operating committee, which included the heads of the five largest divisions; and since a division head on the operating committee was in an anomalous position when his own requests were before the committee, the final decisions tended to be made by the president.

Dial changed this by splitting off the money function and giving it to a new four-man appropriations committee. To staff it, he promoted the heads of three large divisions—plastics, gases, and alloys—to general corporate vice presidencies and relieved them of their divisional responsibilities. The appropriations committee has grown in stature until it has become Carbide's real governing body. To be sure, routine operating matters are left to the operating committee, which now includes all the division heads; and both committees are technically subject to the executive committee of Carbide's board. But the board itself is predominantly composed of management men, who hold seven of eleven seats.* Management's position is further strengthened by the fact that there is no single dominant block of ownership. In fact, the largest blocks of Carbide stock (none exceeding 3 per cent) are held by institutional investors. Carbide stock in recent years has ranked first or second in popularity with common trust funds—i.e., those set up and run by banks.

$1.25 Gets $1.00

Carbide may well have been prompted in its management restructuring by the one obvious corporate boner it has pulled since World War II. To grow as Carbide has done has required enormous capital outlays, for the company must invest well over a dollar in new capital to gain a dollar in annual sales. Carbide's capital spending during the postwar period has averaged about $100 million a year. However, in 1949 top management, then led by President Fred H. Haggerson, was badly frightened by a sudden sales drop. Therefore it trimmed expansion to $70 million in 1949 and in 1950—despite howls of protest from the operating divisions. (Du Pont also cut back its capital outlay in 1949, but resumed its "normal" $115-million rate of spending in 1950.) Carbide's $100-million-a-year average was maintained by spending over $150 million in 1952 and again in 1953; but Carbide's hang-back attitude encouraged competition in chemicals and plastics, especially polyethylene. "In retrospect, it [the cutback] was not a good decision," Vice President Hannan admits frankly. "The operating divisions still throw that decision at us today. We probably should have found the capital and gone ahead."

The Century Loan

Carbide's recent financing history shows that the company has ample talent for finding capital. When it became apparent in 1947 that the planned expansion could not possibly be financed internally, Dial, who was then treasurer, negotiated a 2.7 per cent, $150-million insurance-company loan (now paid down, according to its terms, to $100 million).

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* The outside directors are William S. Gray of the Hanover Bank; George H. Love of Pittsburgh Consolidation Coal; John P. McWilliams of Youngstown Steel Door; and Carrol M. Shanks of Prudential.

Continuing capital needs, coupled with Korean war higher corporate taxes, brought Carbide back to the money market within four years. After a careful look at equity financing, Dial, by 1951 both executive vice president and treasurer, decided in favor of a $300-million, one-hundred-year loan from Metropolitan Life and Prudential at a cost of 3¾ per cent. The loan's great advantage over equity financing, Dial reasoned, was that Carbide would pay no interest before the loan was actually drawn down, whereas new stock would require dividend payments at once. Furthermore, loan interest is a cost, dividends a charge on after-tax profits.

Some 53 per cent of Carbide's $1.2-billion postwar building money has gone into chemical and plastics facilities: the Institute, West Virginia, chemical plant has been doubled in capacity, and new chemical plants or major additions have gone up at Torrance, California, and Texas City and Seadrift, Texas. Even Carbide's original chemicals complex, strung along the Kanawha River at South Charleston, West Virginia, whose 200 acres seemed chuck-full a decade ago, has sharply raised its output to over 1.2 billion pounds a year. Altogether, Carbide's plastics and chemicals divisions have raised their sales to more than three and a half times the 1946 level, and their share of Carbide's total sales from 41 to about 47 per cent.

Flashy sales and profit performance in chemicals has been common since World War II, but alloys and metals (on which Carbide spent 28 per cent of its new construction money) have also done well. Since 1946, Carbide's alloy and metal capacity has doubled; sales have more than tripled, from $100 million to $335 million; and the alloys and metals share of the company's dollar volume has risen from 24 to 26 per cent. The gas and carbon divisions, by contrast, received about half as much new capital per dollar of sales as the chemical-plastic-alloy group and showed smaller sales increases.

The output of the various divisions is sold, as might be anticipated through highly specialized sales groups (there are twenty-eight, with a total sales staff of 5,000). These are at their best in dealing with some large industrial customer (U.S. Steel is the company's largest) whose needs are intimately known. But even large customers are expected to pay for Carbide's expertise: the Linde division, for example, boasts that it not only sells the most oxygen, but is also able to get a slightly higher price for it than the competition because of the extra service it can render —e.g., a complete advisory service on the latest welding techniques. However, Carbide has no equivalent background in consumer merchandising; it has never shown the knack of, say, du Pont or Celanese for promoting an end product in order to stimulate the sale of a raw material.

The Unrolling Future

The expansion now under way or definitely planned will increase Carbide's production capacity sufficiently to support sales of nearly $2 billion a year. But Carbide executives anticipate that the actual sales figure a decade hence will be at least $2.5 billion, and possibly as high as $3.5 billion, at 1956 prices. If present profit margins can be maintained (and management is determined that margins will not only be maintained but improved), after-tax earnings ten years from now might well approach $450 million as compared with last year's $147 million. This glittering prospect assumes that Carbide's earnings will rise faster than its sales partly because the enormous plant write-offs the company is now taking will eventually be translated into higher earnings.

A modest but increasing addition to Carbide's net will come from foreign operations, which last year paid back to the parent company some $17 million in dividends. Carbide operates in twenty-seven countries through forty-two wholly owned and partly owned subsidiaries, which range in size from small flashlight-battery plants in Australia to much larger chemical, carbon, and alloy plants in England, France, Italy, and Norway. Carbide's foreign operations (except for those in Canada) appear on its income statement only to the extent that they pay dividends back to the U.S. The company's foreign equity, carried conservatively on the books at the cost figure of $18 million, has grown through reinvestment of earnings to some $90 million; and will be doubled in the next two or three years upon conclusion of a building program that includes a new chemical plant in Puerto Rico and new plastics (polyethylene) plants in Scotland, Brazil, and India.

To raise sales and earnings to the levels hoped for ten years hence, the company will have to increase capital expenditures from the present $125 million a year to more than $150 million; but cash throw-off from depreciation and retained earnings should obviate the need for new financing. And as it moves closer to the consumer Carbide will also have to sharpen its merchandising. But above all, it will have to spend a great deal of money on research, the results of which will be a long time a-coming. Carbide executives have a word for that kind of spending. They call it "patient money."

In 1962 Du Pont's sales were 2.41 billion dollars and its profits after taxes were 305 million dollars. The present sales volume represents a three-fold increase in the past fifteen years, yet, despite the fact that enormous amounts of capital were required for this growth Du Pont has managed to keep its average net return on investment at 10 per cent.

Du Pont performed a rare feat—it increased sales while maintaining profits. The great majority of firms in most industries are faced with a situation in which they can either increase sales volume or increase profit in the *short run—but seldom both.* How then has Du Pont achieved its enviable status? What policies has it followed and will it follow? Can this company's strategies and tactics be adapted by its competitors? The following selection provides some insights into the functioning of this giant enterprise.

18 How Du Pont Keeps out in Front

by Lawrence Lessing

Last summer E. I. du Pont de Nemours & Co. elected a new president, the eleventh in its hundred-and-sixty-year history. The event was solemnized around the huge, oval board table in Wilmington, under the portraits of past presidents, beginning with the Eleuthère Irénée du Pont who fled the French Revolution for the U.S. and established a gunpowder works in 1802 on the banks of Brandywine Creek near Wilmington—and also established a tradition of skilled family management almost unbroken to this day. Only two presidents in the past century have not been "of the name." One was Walter S. Carpenter Jr., who served through the crowded years of World War II (1940–48) and retired last summer as board chairman; the other was his successor, Crawford H. Greenewalt (1948–62), who this year, at sixty, became chairman. Elected to the presidency was

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Lammot du Pont Copeland, great-great-grandson of the founder, who has inherited (through his mother, sister of the late Pierre, Irénée, and Lammot du Pont) and returned to the office the square, vigorous, big-boned features of this prolific family.

Thus, with a historic demonstration of continuity almost unique in U.S. industry, the largest chemical company in the world faces the challenges of the second half of its second century. The challenges are considerable. For Du Pont and the industry are entering in many ways a new and difficult era of chemical development. It is an era in which Du Pont's strategies must allow for sharpening competition, the spread of technological sophistication, and new balances of world trade. More than ever before, the company will need solutions to all the problems of bigness. When FORTUNE last looked at Du Pont in October, 1950, in a five-part series of articles, it had just passed the $1-billion mark in annual sales; this year it is pressing toward $2.5 billion.

To stay on top in the new era, Du Pont has a strategy—or rather, it has two strategies. For much of its expansion it will depend on a massive assault on lush foreign markets. At home, where the market looks a lot less lush than it used to, Du Pont will work on the pinpoint development of individual markets.

The Figures That Matter at Du Pont

There is a plausible case to be made that the chemical industry is leveling off to a plateau of sales, earnings, and growth more nearly in line with that of older, more mature industries (see "Chemicals: The Ball Is Over," FORTUNE, October, 1961). Through the Forties and early Fifties, chemicals grew at a rate faster than that of all other industry. Earnings ran to about 20 percent of sales before taxes and were used to finance the unremitting plant expansion and heavy research on which all the growth depended. It was a fairly small, compact industry to begin with, and had such high technical standards for entry and so much undeveloped territory that the pioneers rarely encroached on one another. Competition within the industry was nominal and gentlemanly. But following the technical explosion of World War II, and attracted by high profits, nearly everyone and his brother seemed to be getting into chemicals, led by the big oil companies and including representatives from the distillery, aircraft, utility, and machinery industries, and even W. R. Grace, the shipping line. In the classic pattern, overcapacities began to appear, and sharp price cutting and internal competition assailed the industry. *Chemical & En-*

gineering News estimates, in a recent study of ten of the industry's leading companies, that price cutting since 1952 cost the industry at least $3 billion in sales; roughly half of this may be considered lost profits. Since 1955, when many indexes peaked, industry margins have dropped to 13.6 percent before taxes. Dollar sales in 1955–62 grew at an average of 5.5 percent a year, only a little over a point above the rate for all manufacturing. Though sales this year are rising sharply to about $33 billion, some are ready to write chemicals off as a growth industry.

The more optimistic view of the industry holds that, after unparalleled growth in a relatively short period, it has just paused, for the first time, to digest a lot of new elements. This is more likely to be an interruption than a leveling off. Some of the more narrowly based, ill-conceived, hasty excursions into chemicals may be dissolved in a painful shake-out. Even some of the giants may feel a certain temporary and localized constriction. And profit margins may never be quite so fat as they once were. But, the industry's optimists believe, the dynamic nature of the chemical sciences is such that major discoveries are always in prospect, and one or two of them could get the industry to exceed even the growth rates of its immediate past. Chemicals, like other new technological industries, are not bound by the old nineteenth-century patterns of industrial growth.

Applying growth percentages to a billion-dollar corporation like Du Pont can be an interesting but not entirely meaningful exercise. When Walter Carpenter passed the presidency to Greenewalt in 1948, he sportively pointed out that it was a tradition for each Du Pont president to double the business of his predecessor. Annual sales then stood at $783 million, and at the end of Greenewalt's long tenure sales were almost exactly tripled. However, Greenewalt refrained last summer from passing on the same challenge to Copeland. At $2.2 billion, doubling sales obviously begins to get difficult.

Copeland's first year has been a good one for Du Pont. Sales this year will be about 10 percent above 1961, much of it from the intensive development of new markets. And Du Pont pretax earnings from operations, which have declined since 1955 from 30 to about 23 percent of sales, still far above the industry average, will be up sharply this year, probably to a healthy all-time record of around $600 million.

The figure that really matters at Du Pont is another index, the return on investment—which Du Pont defines as net earnings from operations on total current assets and plant, i.e., not counting the G.M. investment. And by this standard Du Pont has performed brilliantly over the last decade, and the one before that too. It has averaged a remarkable 10 percent return. "I don't think any apology has to be made for how Du Pont has done in this period," says Greenewalt, in modest understatement. "To show the growth we've shown and to maintain a rate of return around 10 percent takes some doing."

Furthermore, despite all talk of overcapacity, there is no letup in new investment, on which Du Pont fully expects to earn its usual return. One of Lammot du Pont Copeland's first acts as president was to confirm record capital expenditures for 1963 of something over $300 million—not just to set a record, he carefully explained, but simply to take care of Du Pont's regular round of plant improvements and requirements for new products and processes, which happened to reach a peak this year. Since 1955 capital expenditures have averaged $200 million a year, and for the rest of this decade they may average $225 million to $250 million. Obviously Du Pont is not operating on the premise that this is a leveling-off industry.

Chapter Four: It's Getting Harder

Du Pont is now setting out on what may be thought of as the fourth phase in its long history. The first phase lasted roughly through its first century. Du Pont then was based wholly on gunpowder and explosives, becoming the biggest explosives combine of its day in the settling of the new republic. In this primitive phase of the enterprise, industries were conceived as operating on a single, stable, almost immutable line of products. It ended for Du Pont in 1912 with the historic antitrust decree that broke up the company into three separate entities (Du Pont, Hercules Powder, and Atlas Powder) and strengthened its determination, undertaken some time before, to get into other lines in the then budding chemical industry.

The second phase, therefore—roughly from 1910 to 1930—was marked by diversification through acquisition and merger. Striking out logically from its nitrocellulose base, Du Pont acquired a host of smaller companies to give it a position in paints and finishes, dyes and pigments, acids and heavy chemicals, cellulose plastics and coated textiles, and, through rights purchased from France's Comptoir des Textiles Artificiels, in rayon and cellophane. Also, between 1917 and 1919, Du Pont put some $50 million into the early General Motors Corp., an investment that, with later additions, came to represent 23 percent of G.M. stock, today worth something over $3 billion.

The third phase began toward the end of the Twenties when Du Pont initiated a broad, farsighted program in basic research, signaling the end of its growth through acquisition and the beginning of growth through internal development. In this period, extending down to the present, the mainspring of the modern business became innovation. While the acquisitions gave Du Pont a broad base and a background in established markets, on which applied research soon built many improvements and a structure bigger than the whole of Du Pont before the breakup, basic research into the internal molecular structure of matter gave Du Pont its most spectacular growth. Out of this came neoprene, the first U.S. commercial synthetic rubber, nylon, the first all-synthetic fiber, and an endless stream of new products with which Du Pont moved out well ahead of the competition and became a noted developer of new markets.

The new phase of development is likely to be a period of intensive consolidation and intense competition. This period began with another big antitrust jolt. Belatedly, last year, the courts decided that Du Pont's holding of G.M. stock, some of which it had owned for over forty years, was wrong. Du Pont had fought the suit hard for thirteen years. First it had fought for the right to retain this investment; then, as the decisions went against it, it argued for a plan of divestiture that would not involve excessive taxes (and massive dumping of Du Pont stock to pay them). Last July, Du Pont began the divestiture by distributing about a third of its 63 million G.M. shares to stockholders (the rest must be disposed of by 1965), under remedial legislation that reduced the tax penalty by designating the stock a return of capital. A large penalty will fall on Christiana Securities Co., holder of du Pont family investments, for which a different tax base was worked out. Christiana's total tax bill may run around $65 million.

As it happens, this mammoth divestiture will have almost no effect on Du Pont's own operations or financial position. For years the G.M. investment has been carefully segregated in Du Pont's balance sheet and all income from it has been passed directly to stockholders. The only major effect of the divestiture might be to reduce Du Pont's dividend. So far in this booming year, however, quarterly dividends have been running along at the usual $1.50 per share, and the total at year's end, when G.M. earnings are paid over, is not likely to be much under last year's record $7.50 per share.

A Strategy for Continuing Growth

There is no doubt, however, that Du Pont is operating in a business climate far more competitive than any it has seen in the past. Whereas only a decade ago Du Pont was the only major chemical producer of all-synthetic textile fibers, today there are seven companies making nylon yarn (one of them, Chemstrand Corp., was inducted into the business by

Du Pont itself), four others making polyester fibers, and six others in acrylics and modified acrylics—all major new fibers pioneered by Du Pont. A decade ago Du Pont and Union Carbide were the pioneer U.S. producers of polyethylene, the biggest postwar plastic; today there are over twenty companies in the business. Du Pont will continue to come up with new products, of course. But the long lead time on which it could once count to cash in on such products is dwindling, as more competitors gain the research resources to move in fast on anything new and drive prices down. And while opportunities to exploit new products are shrinking, the cost of discovering them is rising. Lammot Copeland laconically sums up this new climate as one in which "it's getting harder to make a dollar"—but one in which Du Pont shows no diminishing talent for making it.

Always ready to recognize the facts of life, Du Pont has been wheeling and changing with the times. But the corporation's basic institutions seem admirably suited to the stresses of the new era. In its tradition of management, under which presidents have resigned at sixty or earlier and executive replacements are ready in depth all down the line, Du Pont ensures great flexibility and resourcefulness. Around the new president is an executive committee that has been almost completely renewed since 1950, with the last of its older members, Henry B. du Pont, due to retire next summer. The operating departments have risen in number from ten to twelve in the same period, and, with only two exceptions, they have a fresh set of general managers. Meanwhile, moving steadily up the line is other executive talent, including younger, eligible du Ponts, a fair representative being Irénée du Pont Jr., engineer and currently assistant production manager in the Film Department.

The elevation of a new president brings no great change, for it is the executive committee that really runs Du Pont. Indeed, Lammot Copeland, who had been a member of the executive committee since 1959, participated in making most of the policies that he now implements as the committee's chairman. The committee operates in a way that is deliberative, democratic, and almost timeless and unique to Du Pont. The president as chairman has only one vote on this committee, and he is surrounded by members who have moved up from the operating departments, engineering, and research. All but one on the present committee hold degrees in chemistry or engineering (Copeland himself holds a degree in industrial chemistry from Harvard), and they bring to the task technical or research-oriented backgrounds in Du Pont. Each sits as adviser to the departments in some broad area, such as research, engineering, finance, or sales, but none can issue orders on the operational level to any department. The operating departments run their own businesses, each as big as or bigger than many individual companies in the industry. And that is Du Pont as it has long continued to run.

Financially, Du Pont works from an equally flexible position in depth. Du Pont, of course, is financially something of a phenomenon. It has had no debt whatever since the early Twenties (when it borrowed $30 million for one of its G.M. stock purchases), and it finances all expansions and capital expenditures out of earnings, while still turning over some 80 percent of net income to dividends. To the argument that it would be cheaper to borrow, it has always turned a deaf ear. Its cash and short-term marketable securities available to meet contingencies run along at some $350 million year in and year out. And its average operating investment per employee (total: 90,000) now stands at an estimated $37,000.

Its financial conservatism is related to a broad, deeply rooted policy of restraint in pursuing growth. Du Pont never pursues growth just for its own sake. It does not as a general rule, for instance, "integrate backward" to raw materials, as others have been doing, except where it is demonstrably profitable to do so, preferring in general to keep flexible by buying basic chemicals outside. And Du Pont does not venture into new products unless it has thoroughly explored the markets for them. Unlike the rest of a largely production-oriented industry, built up in the past mainly on basic chemicals, Du Pont has been market-oriented from the beginning of its earliest modern phase. "Growth per se is meaningless," says Crawford Greenewalt. "Rather, it's a question of soundness and worth." And for Du Pont, soundness means hewing to the line of a 10 percent return on investment.

To maintain this in today's harsher competitive and economic situations obviously requires an extraordinary efficiency, and Du Pont never stops trying to rationalize its operations still further. To keep costs down and ahead of competition, it has kept plants, processes, and engineering up to new heights of technological efficiency. It has just completed a total modernization of its sulfuric acid plants. The largest chunk of the current construction program, some $70 million, will go to a new nylon raw-material plant in Louisiana and to improvements in other nylon plants at Seaford, Delaware, and Martinsville, Virginia, which have been expanded and practically rebuilt at least six times since their openings in 1939 and 1942. At the same time, Du Pont has hardheadedly closed out businesses that no longer pay. It has shut down all but one of its black-powder plants, the product that started the business, while explosives generally are down from less than 10 percent of sales in 1950 to less than 3 percent today. And by next June, Du Pont will have closed down all operations in rayon, the product that provided its start and mastery in synthetic textile fibers, and that became the biggest operating department in the company. Lopping it off was a great sentimental wrench, but it was lopped off all the same.

The company has also worked hard on several organizational efficiencies. Within the past year Du Pont has set up a Consumer Products Division to consolidate and strengthen the development and marketing of consumer products. It has set up a New Ventures Division to cull promising new businesses from the interplay of products and processes in its regular operating departments. (The first new venture to come out of the division was a line of analytical and control instruments developed for the company's own processes, and now ready to be sold outside.) Du Pont also has bought a minority interest in a small Massachusetts electronics firm, Block Engineering, Inc., which is especially strong in infrared technology. And Du Pont has been tightening and deploying the organization of its industrial departments—stripping Plastics down to the single interest of plastics production, separating out Elastomer Chemicals—for a more concentrated attack on broad market areas.

But in a company that is already as well organized as Du Pont, the payoff on new efficiencies is necessarily limited. Any larger payoffs must await the results of Du Pont's big new move abroad and its new strategic approach to the U.S. market.

The Big Common Market Adventure

Until the mid-Fifties, Du Pont's foreign business never amounted to much more than 6 percent of total sales. This was made up mainly from licensing fees, some exports, one Mexican explosives plant, and three joint ventures with Britain's Imperial Chemical Industries, Ltd., in Argentina, Brazil, and Canada. (These joint ventures were struck down in 1954 by another antitrust action.) Du Pont's hands, capital, and skills were too preoccupied with exploiting the vast U.S. markets. But as those markets began to reach a high state of development, and with mammoth growth in the U.S. increasingly likely to get antitrust attention, Du Pont suddenly picked up interest in the foreign field. Decisive to its new interest was the remarkable growth of the European Common Market, which finally created markets, previously repressed by national boundaries, large enough to fit Du Pont's mass-production skills. In 1958, Du Pont set up a full-scale International Department. Today it has thirty-five foreign plants in thirteen countries, employing close to 16,000 people, with a total investment of $320 million. Total foreign sales this year are estimated at some $400 million—i.e., over 15 percent of Du Pont's total, and greater than the total sales of the entire company in

1940. The total foreign operating investment is climbing at the rate of 12 to 15 percent a year.

Du Pont has moved especially fast in Europe; from nothing in 1958, the European investment has shot up to $100 million. The company started in 1956 with a decision to build a neoprene plant in Northern Ireland, completed in 1960, and since then has been moving into Holland (Orlon, Delrin plastics, and Lycra spandex fiber), Belgium (paints and finishes), France (herbicides, isocyanates), Germany (pigments), Sweden (paints), and Spain (fungicides). A central sales and export company also has been set up in Switzerland. Some of these plants are owned wholly, others in partnership. This fall Du Pont wholly acquired Germany's Adox Fotowerke, employing some 2,000 persons, to give it a strong European base in photographic products. In addition, it took over its half of the joint I.C.I. companies in Latin America and Canada, has added companies in Mexico and Venezuela, and has entered into two new joint companies in Japan, one in polyethylene, the other in neoprene. And expansion is in progress in all these foreign areas, from Europe to the Far East, to the tune of $10 million to $20 million each.

One reason for Du Pont's speed is that it was behind other U.S. chemical companies in moving into foreign markets. Another reason is that the European market has been growing so lustily; it became clear that if Du Pont did not get into plant construction on certain of its products, then others, particularly the Germans, would. Since Du Pont has no patent preemption on most of these products, it has had to move even faster than it would in the U.S. Competition in the Common Market is no less fierce than it is at home.

So far, Du Pont's foreign manufacture, which is wholly for foreign sales, has not tended to cut down its exports; rather surprisingly, the reverse is true. Du Pont has found that when a new plant is first announced for a country, there is a surge of export business, with customers' interest in a product whetted by the knowledge that it will later be available locally. In the case of its neoprene plant in Northern Ireland, for example, Du Pont found that, in the period between announcement and completion of the plant, the volume of its neoprene exports to the United Kingdom exceeded the cost of the plant two or three times over. Furthermore, exports hold up well even after the new plant is built. Du Pont's explanation is that the new organization abroad has a base for an effective sales effort that can move products besides those manufactured there. The payoff has been dramatic: while most of Du Pont's rise in foreign sales this year is from its new plants, export volume also is up over 1961.

As exports approach a volume at which further foreign manufacture becomes justified, total exports may yet be cut. But the bigger base thus secured will still leave a net gain for Du Pont. "It's like having another whole new U.S. market open up," one executive-committee member says. It is a market for products whose big costs—i.e., development, processes, and plant designs—have already been incurred in the U.S., so that the returns on investment abroad are healthy.

Du Pont is understandably excited and bullish about its foreign adventures. It has engineers carefully investigating new products, locations, and markets over the world. One area it is seriously looking at is India, another is Australia, and it even has some ideas cooking in Africa. "It's fantastic," says the new International Department's general manager, W. Sam Carpenter III, son of the former president, "the range of places and things we can go to and do."

The Battle on the Brandywine

Meanwhile, back on the banks of the Brandywine, Du Pont is pressing the much more complex battle of U.S. markets no less vigorously. The frontal attack is on synthetic fibers, plastics, films, and rubbers, which together account for some 50 to 60 percent of its business. This, indeed, is the heart of the business, not only economically but chemically, for all four of these product divisions are essentially plastics or resins in different physical forms. (Nylon, for instance, is both a filament for gossamer hosiery and a solid for tough, abrasion-resistant gears.) All four are based on the great discovery of the Thirties, in which Du Pont played a leading role, of the means of putting together big, long-chain molecules or super-polymers, a discovery that accounts for most of modern chemistry's spectacular growth.

The situation today is not simply that there are more competitive companies in polymer chemistry, but that there are many more competitive molecules or products within the industry itself, created by the amazing versatility of chemical synthesis. Historically, the role of chemistry has been the replacement of natural products, and this is still the major competitive background. But now, with half a dozen major families of synthetic fibers in production, and over a dozen families of plastics and films, there is a great overlapping of properties, a great many applications in common, so that the scramble has sharpened considerably within the synthetics themselves. For instance, competing with cellophane today are a host of polyvinyl, polyethylene, polyester, and polypropylene films, unrelated chemically, all of which Du Pont itself makes to maintain a broad base in films. This is called "supplantive competition," on a functional rather than a chemical basis, and it is increasingly rough.

Du Pont's strategy is to press on to new refinements of specialization, tailoring the basic-product molecule to specific end uses, to ensure a place above the competitive ruck. Take nylon, for instance. Twenty-three years after its introduction, it remains the star of Du Pont's market creations, with over thirty types of nylon filament and yarn developed for specific uses. Among them is a range of "BFC" nylons, specifically developed for loop-pile carpeting, overcoming "pilling" and other drawbacks, which since 1958 has opened wide the rug market to nylon. And a new development in tire-cord yarn puts nylon in position to bid for the original-equipment market (it already has a big part of the replacement market) by eliminating its tendency to "flat spotting" when tires stand too long. (Much the same sort of pinpoint market development is going on in Du Pont's other major fibers, Orlon acrylic and Dacron polyester.) Hence, contrary to the impression of some that it is a product long past its youth, nylon is still among the biggest of Du Pont's products in volume and earnings, and is still growing.

The Boiling Pot of Polyolefins

The same intensive development is going on in Du Pont's biggest plastic, polyethylene, which will reach a volume of close to 400 million pounds next year. The polyethylene market offers a good example of the present uneven state of industry capacity, as well as of the sharp infighting of supplantive competition. Polyethylene shows the most precipitous growth of all plastics since World War II, up to around two billion pounds this year. A waxy, supple, versatile material, it is the leading member of a growing class of plastics called polyolefins, derived from relatively cheap and plentiful petroleum gases, which is what has attracted over twenty producers into the business. It is rolling in overcapacities, with prices ranging from around 14 cents a pound for off-grades to about 36 cents a pound for high-quality material. Conventional or high-pressure polyethylene, the first type in the business, is relatively in balance, but some overcapacity is disturbing linear or low-pressure polyethylene.

Complicating the situation since 1957 is the entry into the market of polypropylene, a close polyolefin relative of polyethylene, with many similar properties and uses, which currently is staggering under a large overcapacity. Seeing the spectacular growth of polyethylene (1961 sales: $1.6 billion), some producers and financial writers jumped on polypropylene as the next big, glamorous "growth" plastic, with special advantages for films, rug and rope filaments, and a new textile fiber. Today some 450 million pounds of annual capacity has been built in polypropylene, spread among more than half a dozen producers, led by Hercules Powder Co. and including a foreign invader, Novamont Corp., wholly owned subsidiary of Italy's Montecatini, early developer and promoter of polypropylene. But for 1962 polypropylene sales will be only about 140 million pounds—a mere 30 percent of capacity—and no one yet has made a profit.

Du Pont thinks this is a fantastic situation. It makes no polypropylene of its own at present, though it has been doing basic work on it since 1954. Instead, it is buying small quantities of the plastic from Hercules for resale, in a cautious attempt to find its right niche in the fast-moving polyolefin market, which is bursting with still other developments. Polypropylene, though superior to polyethylene in some applications, such as special packaging films, has certain disadvantages, the chief one being its cold-brittleness, which has kept it out of containers, a major polyethylene field. And as a fiber, polypropylene not only has some technical difficulties still to be solved, but it is yet to enter the most costly phase of textile development. It is a situation to be watched, however, and Du Pont has a wary eye on it. This fall it plunked down, as a challenge and a test, a basic catalytic patent in polypropylene, which it believes covers all present production. In the uproar that followed, Montecatini calmly announced a $26-million expansion and development of its U.S. subsidiary.

Du Pont elected to stay with polyethylene, and to keep its head above the situation by intensive market development. It now has over fifty types of polyethylene. In coating resins alone, for bonding protective films to paper, boxboard, metal foils, and the like, it has fourteen different types, each fitted to a particular application. Among them is a new plastic coating for milk cartons, which is replacing wax and rapidly taking over the business, estimated for Du Pont and others at some 130 million pounds a year by 1965. This is the kind of mass marketing—supplying an improved wisp of material to a universal commodity—that Du Pont likes to get into. At Parkersburg, West Virginia, where the rest of Du Pont's plastics are made—the Lucites (acrylics), Zytels (nylons), Butacites (polyvinyl butyral for safety glass), Teflons (fluorocarbons), and newest Delrins (polyformaldehydes)—a big computer is required to juggle production schedules for over 100 basic types and 2,700 formulations. All plastics are still growing in volume at a rate of 12 to 15 percent a year, and Du Pont is getting its share.

The Duel over Delrin

No matter how fast and smartly Du Pont moves, however, it can no longer count on enjoying a new market alone for very long. The industry, which has been heavily based on production of basic chemicals in the past, is rapidly shifting to follow Du Pont's lead in market orientation and development. If nylon were invented today, for instance, it would not have clear sailing for about fifteen years—as it did—but for something less than ten. Du Pont introduced its new plastic Delrin in commercial quantities in 1960, and only two years later Celanese Corp. jumped in with Celcon, a plastic arrived at by a slightly different route but much the same as Delrin. And in even shorter time than that, only about a year after Du Pont introduced Lycra—a yarn with unusual elastic-like properties built into its molecule, now moving in on the girdle, bra, and swimsuit trade—the company found itself facing a half-dozen competitors.

Delrin is the classic story of the industry in these changed times. It took over ten years and $10 million in research and technical development, including three years spent in careful market evaluation—exploring over 500 end uses in cooperation with some 250 companies—to get Delrin into production; the total development cost was some $50 million. The comparable cost for nylon was $27 million. Yet Delrin, a tough, high-strength plastic for replacing metals in many applications, is not another nylon so far as volume is concerned. It is an engineering plastic for specialized uses. The estimated market is some 200 million pounds a year by 1970, all of which Du Pont might have expected to supply in a happier day. When Celanese announced its entry, Du Pont almost immediately slapped down a patent-infringement suit. The polymerization of formaldehyde had been attempted unsuccessfully for many years in many laboratories, and in doing it first Du Pont believes that it has a clear priority in composition, covering all methods. Celanese says it too had been working on its material independently for a long time. Du Pont's strong feelings about the case have been reflected in the tough new patent policy adopted to protect its innovations. The company may, if successful, exact royalties, collect damages, or shut down Celanese's operation entirely, as a warning to others. For, if three or four producers were to get into polyformaldehyde, Du Pont maintains, it would not be a profitable business.

Meanwhile, Du Pont, with at least two years' headstart and some 30 million pounds in plant capacity, has been busy cultivating Delrin's market. As sales developed, it rapidly cut prices from 95 to 65 cents a pound to widen markets still further. So far, with the biggest share of polyformaldehyde sales, running this year to well over 15 million pounds, Delrin is developing about as projected. It is gaining new commercial uses at a rate of about two a day, mainly in replacement of die-cast zinc, aluminum, and brass.

In addition, Du Pont has taken an entirely new tack in development. After arduous extension of Delrin's tough, corrosion-resistant properties, it has just built a new plant in Tulsa, Oklahoma, where Delrin pipe will be extruded for the oil and gas utilities fields. And Du Pont is building a plant in Holland that, until it is backed up with chemical production, will take Delrin polymer from the U.S. and extrude it into rods, sheets, tubes, and other finished shapes. Ten years ago Du Pont would never have carried a product like this into the finished state, for it was a fixed policy to stop short and allow others to develop end markets. This is still the general policy—Du Pont could hardly afford to get embroiled in such big, well-established industries as textile weaving or automotive parts—but the exception is significant of the competitive times.

The Troops of Research

To keep up this pace over an immense range of products, Du Pont pours in supporting research and development on a scale that few competitors can match. Indeed, the weight of this kind of research and development grew so great, tending to distort Du Pont's reporting of what it regards strictly as basic research, that three years ago it decided to separate all of its research into two categories in order to simplify accounting. The first and still primary area, now designated pioneering research, is devoted to the discovery of new knowledge, new products and processes, pursued entirely separately from the going business; this is running along at some $60 million a year. The second category, called supporting research, is the improvement and market development of established products and processes, closely tied to industrial operations; it is not reported separately, but it easily exceeds the primary-research budget.

The new concentration on supporting research is visible in a $20-million technical-service laboratory complex that has risen on a campus site at Chestnut Run, near Wilmington, since 1954. Here eight operating departments now have laboratory buildings loaded, not with test tubes, but with all the types of production machinery used in the industries their products serve. On this equipment new products are tried out and their deficiencies defined, new uses are developed for existing products, new manufacturing processes are explored, new markets are evaluated, and customers are aided without charge in solving the problems of using and developing Du Pont products in new businesses.

Chestnut Run is Du Pont's insurance in navigating the increasingly costly, competitive, volatile, and hazardous currents of market development. That the risks can be high was illustrated just before the first technical-service laboratory arose—the Textile Research Laboratory—when Du Pont made one of its few big market miscalculations. In 1951 the first Orlon plant, designed to produce continuous filament, was barely completed at Camden, South Carolina, at a cost of $15 million when the company realized that the fiber was too silky to succeed as a rugged outdoor and industrial fabric, the markets for which it was projected. The filament piled up in warehouses, and the plant was finally shut down completely in 1956. Fortunately, however, Du Pont had a second Orlon plant in process, completed in 1952, designed to make staple or short fibers. And staple proved to be a whirlwind in sweaters and knitwear, the acrylics, all told, capturing some 50 to 60 percent of the market. While it is still trying hard to develop other markets for Orlon, Du Pont has nimbly run its staple capacity up from 30 million to some 120 million pounds a year.

All this has engendered a slight shift in Du Pont's research viewpoint. There is naturally more research of all kinds—the population of the central Experimental Station, fountainhead of pioneering research, has gone up in ten years from 2,600 to 3,300, of whom 1,143 are scientists or technicians—but, to keep on innovating, Du Pont has had to turn more attention to smaller research gains. "You can't count only on the great big developments to keep you profitable and healthy," says Greenewalt. "They're damned important, but the unsung smaller and more numerous research accomplishments are what make your business grow and prosper."

Probing for New Markets

Nevertheless, Du Pont keeps moving on ever newer markets. Nothing as big as nylon is yet on the horizon. Nylon was a great basic discovery, the first conscious design of long-chain polymers, and such coups do not come frequently. Moreover, when a market becomes as well developed as the synthetic fibers are, with a broad choice of available types and properties, it becomes harder and harder to develop a new material. Du Pont has examined—and continues to examine—thousands of possible fibers without yet seeing one unusual enough to warrant the tremendous investment needed to get it into textiles. Still, synthetic fibers have captured only about a third of the total textile market, and plenty of opportunities remain, particularly in the huge domain of cotton used for sheeting and the like. Plastics have only begun to cut into the building and construction fields with materials of any stature or volume. And the whole exciting field of biochemistry is still largely frontier.

In a dozen directions, Du Pont is always probing with new products to find new markets. It has just announced a multi-million-dollar plant, scheduled for completion in 1964 at Old Hickory, Tennessee, to make a new plastic material, already widely market-tested, to compete with leather in shoe uppers of all kinds. A "poromeric" or breathing material, closely resembling natural leather in feel and appearance, it probes the kind of mass market Du Pont seeks. The company plans to enter the amateur photographic-film market for the first time next year with a new color film, to be distributed by Bell & Howell.

Du Pont is in production in Baltimore on a new high-temperature alloy known as TD nickel for jet engines, rockets, spacecraft, and process equipment. This is based on the discovery that dispersal of thoria or other oxides uniformly through the crystal structure of such metals as nickel, copper, aluminum, cobalt, iron, tungsten, and molybdenum markedly increases their operating strength at high temperatures—in the case of nickel, tripling or quadrupling the strength at 2,400°F. It also is producing new columbium alloys for space use with useful strengths above 2,500°F. And it has new high-temperature nylon, polyolefin, and Teflon plastics of remarkable strength coming out of development, mainly for space, but available later for entirely new developments in buildings, appliances, pipe, and structures of all kinds.

On the Unending Frontier

Not to be neglected is the pioneering research from which new products flow. Out of it recently, for example, has come a new discovery in magnetism: it was shown that a brittle, gray manganese antimonide compound becomes magnetic as temperature rises above a precisely determined point, contrary to the pattern of all other known magnetic materials. And out of Du Pont's increasing interest in the biological sciences have come two even more recent discoveries. One is the separating out of nitrogen-fixing chemicals from bacteria and a demonstration of the processes by which living cells create nitrogen compounds, the building blocks of all life and growth. The other discovery is of compounds that uniquely short-circuit the energy-transfer systems of living cells, as in photosynthesis, the process by which green plants synthesize starches and grow. Out of this may eventually come new, highly specific weed killers, insecticides, or drugs, nontoxic to other forms of life.

What the industry's gloomy analysts do not yet understand is that there is literally no end to these scientific discoveries, from which new developments and products will come, and hence there is no end to growth. Discoveries cannot be ordered or scheduled, much less imagined beforehand by the practical and literal-minded; but to the receptive they come. Du Pont might easily double its present size by the early Seventies, given a climate in which bigness per se is not considered evil. "It would be footless to try to say what our sales will be in the future," says the eminently pragmatic Crawford Greenewalt, "but I would predict that our health will be excellent."

Part Three

The Human Resources of the Chemical Organization

In 1960 there were approximately 3,600,000 people employed in the chemical process industries. Chemists, engineers, accountants, lawyers, skilled and unskilled laborers—all the efforts of this valuable industrial resource must be directed toward the objectives of the enterprise. Even small gains in the efficiency with which the human resources of the firm are managed add up to substantial cost savings. For example, in the chemicals and allied products industry, which is just one part of the group of industries subsumed under the heading of "chemical process industries," approximately 830,000 people were employed in 1961. These employees received 6.37 billion dollars in wages in that year. But profits for this industry branch were only 2.05 billion dollars during that period. Thus a 5 per cent saving in labor costs (certainly within the realm of practicality, e.g., either by reducing the size of the labor force or by improving its efficiency, or both) would amount to more than a 15 per cent gain in profits for the chemicals and allied products group.

It need hardly be emphasized that the proper management of human resources is just as vital as the management of the other resources of the enterprise. In the past few years a great deal of research has been performed which points the way to effective utilization of the human resource. Unfortunately, there is a considerable time lapse between conducting such research and putting its results into practice.

Chemists and engineers constitute a large proportion of the CPI's management team, e.g., 46 per cent at Union Carbide. Thus, it is incumbent upon CPI professionals, as well as all other management personnel to become familiar with and use the proper principles of handling human resources in a complex technological society. This is particularly true in today's CPI, where the "big" problems are becoming less and less technical in nature and more and more concerned with the enterprise's relationship with its employees—problems of motivation, communication, rewards, and so on.

The following selection sets forth some of the key elements of an approach that is considered to be most suitable for handling people in today's CPI. This philosophy, that of the world's second largest chemical firm, Union Carbide, is outlined by Carbide's vice-chairman, Howard S. Bunn.

19 The Engineer in Management

by Howard S. Bunn

If any single thing could be said to stand out as a primary responsibility of the engineer in industry, it would probably be his responsibility for practical technological innovation. However, I'm going to talk with you tonight about the engineer in management—more specifically, human management—a field which needs practical innovation just as much as the most rapidly developing technology. It is a field which has been severely,

Reprinted with permission. Mr. Bunn, Vice-Chairman of the Board of Directors, Union Carbide Corporation, delivered this paper before the American Institute of Chemical Engineers, New York Section, on September 16, 1960.

and often unjustly, criticized by many writers and speakers during the past few years.

In 1922, I graduated from Lehigh University as a Chemical Engineer, and immediately went to work for Union Carbide Corporation. The ensuing 38 years have been interesting and exciting.

Last June, I returned to the Lehigh campus to attend Commencement exercises and heard the Commencement speaker, Dr. Allan Nevins, the eminent historian of Columbia University, talk on the subject, "Born Free But Accepting Chains." He told the graduating class, and I quote:

> The central indictment of the world of large-scale business into which young men enter today is that it places a standardizing and leveling weight upon the people whom it absorbs. It increases the degree of uniformity and conformity, of passivity and conservatism, in American life, and enlarges the world of authoritarianism. It does this not in one way, but in many.

Referring to large business organizations as "economic concentrations," Dr. Nevins also told the students:

> They pay lip service to individualism and say a great deal about the value of leaders and specially brilliant men. But actually they prefer someone who keeps close to the center of the boat. They train men to think as the boss thinks, to respect red tape, and to refuse to take any chance that might turn out to be a mistake.
>
> Group harmony, in this system, is the important goal; and where authoritarian pressures are heaviest, the American corporate bureaucracy can look unpleasantly like the Russian collectivist bureaucracy.

These are strong words. I don't know what effect they had on the graduating seniors at Lehigh, but I am becoming deeply concerned about the tendency of influential speakers and writers to lambaste American industry because it's big and because it's organized. I don't think either of these facts necessarily mean that American corporations resemble "Russian collectivist bureaucracies," and I do not believe that young men with good minds view industrial corporations in that light.

I do express concern over the growing notion that industry wants only conformists and that large corporations are inert monsters that stifle individuality and initiative. I feel that nothing could be further from the needs of American industry nor from the objectives of its top management. A corporation is a living organism—not a mechanism. Parts grow old and die. New parts grow and flourish. No corporation can be a vital force for growth and progress unless men of inquiring mind, stout heart, and stubborn persistence are attracted to it and work hard for its growth and progress.

I am disturbed by these negative implications for I know all American corporations are not entirely perfect either. Unfortunately, as organizations become larger and more complex, the tendencies toward conformity and submergence of the individual can become stronger. Where this happens, however, I believe it comes about largely because of apathy on the part of managers and subordinates alike, not because of a conscious desire on the part of management. Rather than argue with Dr. Nevins as to the existence and degree of conformity, I am much more interested in examining some principles of management which, in my opinion, will insure against the conditions which Dr. Nevins and others see in our industrial organizations.

Our studies within Union Carbide, and those made in other companies offer convincing evidence that a major part of the problem is related to the fact that in the last fifty years the composition of the human resource of industry has changed significantly while our principles of motivation, human organization, and management have really changed very little. Since you yourselves are part of the change in the nature of this human resource, I think you will be interested in some of the findings.

One of these studies, entitled "Manpower and Innovation in American Industry," was completed in 1959 by Samuel E. Hill and Frederick Harbison of Princeton University. They noted, for example, that in 1910 professional and related people accounted for less than 1 per cent of the work force in manufacturing industries of the United States. By 1957, the professionals had risen to more than 7 per cent. Of even greater interest to you is the fact that the occupations of engineer and chemist were shown to have been growing at an unusually rapid rate. In 1890, for example, engineers and chemists accounted for .14 per cent of gainfully employed people. By 1950, they accounted for 1.11 per cent of the work force in civilian employment. The authors go on to point out that in the period from 1952 to 1957, employment of professional, technical and kindred workers in manufacturing increased by 45 per cent and rose by 27 per cent in the two-year period from 1955 to 1957.

The central conclusion of the report is that this greater employment of high-talent manpower is largely the consequence of innovation, not really the result of Parkinson's Law.

Even more significantly, however, the authors conclude that future economic growth depends to a considerable extent on even more spectacular expansion in the employment of high-talent manpower, and that in order to be more effective, high-talent people will need to be motivated by entirely different concepts of industrial environment, organization, incentives, and relations between managers and the managed.

Certainly the character of our jobs is changing rapidly. More and more of them are "idea" jobs requiring restless inventive minds. Traditional management practices designed to deal with routine jobs and ordinary assembly lines seem to be neither appropriate nor effective for our present day situation. Organizational principles that are directed at narrowing and specializing all jobs do not meet our needs for breadth and flexibility.

Chemical engineers, for example, can no longer be content with a narrow professional orientation nor can engineering management afford to encourage such a viewpoint. The importance of the engineer, and specifically the Chemical Engineer, in the management function can be illustrated in our own company.

As of mid-1960, there were 1,670 Chemical Engineers in Union Carbide—246 in Engineering, 385 in Research and Development, 646 in Production, 178 in Sales, and 215 in other departments. Considering those who are responsible for the work of other people, 776 of these engineers or 46.4 per cent are involved in the management of the Corporation and its Divisions.

When I graduated as a Chemical Engineer, the emphasis in the curriculum was on practical engineering with equipment design as a prominent part. In the intervening years, the emphasis has shifted more and more to the analytical, theoretical aspects.

The "mass points" of usage for Chemical Engineers have similarly shifted from design to production, and from production to research and development. 46 per cent of the Chemical Engineers hired at Union Carbide last year went to Research and Development. Only 29 per cent were assigned to Production and 16 per cent to Engineering, as such. This is not surprising when we note that Union Carbide industrial research expenditures more than doubled between 1953 and 1959.

My point is that technological innovation is the lifeblood of industry and of prime concern to engineers. The danger is that as we become entranced with our ability to produce technological improvements, we tend to forget that all such improvements spring from the creative energy and imagination of people.

Engineering management has a real responsibility here. I would be the last to deny that professional and technical competence are of increasing and absolute importance in today's complex industrial picture. However, we need engineers who are also businessmen, who can evaluate and plan the consequences of their professional work, and who can manage the human assets of industrial enterprise in ways that are appropriate to the kinds of minds involved.

What is appropriate? I am much impressed by the thinking of such men as Douglas McGregor of MIT, Mason Haire of the University of California, Rensis Likert of the University of Michigan, Chris Argyris of

Yale, and other serious observers of industry who are, each in his own way, urging industry to make a serious reevaluation of its assumptions, principles, and practices with respect to the management of its human resource.

In Union Carbide, we have reached the firm conclusion that the growth and health of our business rests on the creative energy of our people, and we are devoting considerable effort to examining how we can best release and guide that creative urge.

This process of self-examination can be rewarding. Throughout industry many questionable practices and policies have grown up over the years to become "principles of management" simply because many managers have never taken the time and effort necessary to examine them and challenge their validity. In some instances there has been reliance on "gimmicks" and "programs" to solve human problems piecemeal rather than attempting to review the principles that underlie our difficulties.

Success in business depends on the ability of management to predict and control—markets, finances, sales, costs . . . and people!

A significant factor in business success is the ability to manage human resources effectively. Industry has traditionally tried to do this by devising rules and regulations, and by imposing control by authority from the top downward through the organization.

We often act, in industry, as though people were inherently lazy, stupid, lacking in ambition, and indifferent to organizational needs. Actually, people aren't this way by nature, but they sometimes appear to be in certain organizations. I would guess that we are lucky if we are able to utilize as much as 50 per cent of the human talent and energy available to us. Over the years, jobs have become compartmentalized, communications have become strangled, and many people have become passive and apathetic because the management climate of their organization has frustrated them to a point where they seek release for their creative energies elsewhere.

Good minds are not stimulated by dictatorial procedures nor are they inspired by authoritarian managers. When we fail to realize a good return on our investment in a man, in far too many instances it is because we have not made it possible for him to contribute that which he would be able and eager to contribute under other circumstances.

What other circumstances? I think we need to be reminded of the central principle which is the basic strength of our entire economic, political, and social system. President Eisenhower, in a recent address commemorating Freedom Week, expressed it this way: "The most powerful and creative force on earth is the concept of freedom which imposes on the individual responsibilities commensurate with the rights and privileges it guarantees to him."

How can we apply this force in industry? I believe we can make it work if we will really apply some principles that are widely accepted in theory, but very difficult to put into practice. The practice of these principles will, I believe, create a climate conducive to the kinds of human performance we seek.

Practically speaking, no single individual can hope to establish the climate for a large industrial organization. On the other hand, every large organization is made up of hundreds or thousands of smaller organizations. Every executive, every manager has a relatively small group of people working directly with him who look to him for leadership. Working climate is built at each working level, and this means that the manager himself is primarily responsible for creating the conditions under which the people associated with him will be motivated to give generously of their talents and interest.

I have spent considerable time examining my own responsibilities in this area. As a senior officer of Union Carbide, I have a responsibility for enunciating principles in which I believe. I am also responsible for encouraging our executives and managers to examine their own principles of management and their assumptions about the people who work with them. Finally, and this is the most challenging of all, I am responsible for living by the principles I support, so that my own close associates are convinced by experience that these principles are worth while. What are these principles?

First of all, I believe that people bring to an organization a desire to achieve, to do a good job, and that, therefore, it is the responsibility of the manager to encourage and support the individual in his struggle for achievement.

I believe that people work best when they have an objective—an objective which they have helped to formulate and identify. Therefore, I believe it is also the responsibility of the manager to have his people participate in setting realistic objectives for the function he manages. Our primary objective is to earn a profit. This profit must represent an adequate return on the investment made by our shareholders.

These profit objectives can only be realistic when those setting them are intelligently informed with respect to the objectives of the larger organization and the problems which must be solved before the margins of profit can be attained. This means that the manager must be responsible for informing his people accurately and frequently with regard to the state of the business and the situation in the market place. He and they must understand that we live in a competitive world and that their costs must be kept in line.

I believe that the essence of communication is understanding, and that understanding is best achieved when everyone hears the complete story. Thus, the manager is responsible for maintaining an atmosphere of open and candid communication within his organization. When *all* the group understand the economics of the operation, the pressure for extra frills, services and additional expense will subside.

I believe that we must have risk takers and that risk taking must be encouraged. Without it we would have fewer new products and not many new processes. But we don't always win and it is the responsibility of the manager to accept mistakes as part of the learning process. He must, of course, be sure his people learn from their mistakes.

I believe that a man's interest in what he does has much to do with the caliber of his performance and that, therefore, a young man coming into an organization should be exposed to more than one type of activity. He should be given the kind of work he likes to do.

I believe that both the individual's suggestions and small face-to-face group discussions are vital ingredients of improving operations. I believe that such discussions are a vital part of the decision-making process, but that few decisions can or should be made by groups. I also believe, however, that individuals will make quicker and better decisions if they have the resources of the group behind them.

Finally, I believe in leadership management—and this applies at all levels—the President, Works Manager, Laboratory Group Leader, District Sales Manager or Foreman. A good manager is neither a dictator nor an abdicator. He is an innovator, particularly with respect to finding ways of improving his department's performance and keeping his organization on their toes. He is a communicator of information which his organization needs. He confidently expects good work and believes in the ability, honesty, and motivation of the people in his organization. He is objective in evaluating the performance of his people and discriminating with respect to the economic rewards they receive. He recognizes that competent and outstanding performers do not like to carry the load for incompetent performers. He conceives a vital part of his job to be that of assistant and coach to his subordinates, and he takes pride in their improvement. In short, he takes the lead in creating a management climate in which growth and progress and innovation can flourish.

I believe that such a manager will work hard at a concept of disciplined freedom—freedom with responsibility—that aims at maximum self control on the part of individuals and a minimum of coercive control on the part of management.

Obviously, everything I have said here tonight applies not only to the engineer in management but to all others so engaged. But there is a good reason for addressing these thoughts specifically to managers with an engineering background. I think you will find the practice of these principles, day in and day out, an extremely difficult and challenging task requiring the careful planning and thorough checking that is the hallmark of the engineer. The difference between lip service and practice in this area represents a profound change in the management of human resources in industry—the kind of change which engineers are most capable of making.

The organizational structure is the basic frame upon which the parts of the organization are constructed, just as the skeleton of the individual provides the support for his organs. Not only is it necessary for the individual parts of the company's organization to be well constructed, but the overall frame must be such that the parts can work together towards a common objective.

The task of building an efficient organizational structure is a difficult one, and is complicated by the fact that the organization must operate in a frequently changing environment. A consequence of this is that the organization, in order to survive, must also change frequently. Without adaptation to external as well as internal conditions, the industrial organization, like the living organism, will decay and eventually cease to exist.

The question then, for the CPI firm, is, "How shall we organize to do business tomorrow, considering the objectives and needs of our firm, our resources (men, money, materials, technology, and so on), and the environment in which we operate?" In the first of the two following case studies, the reader is presented with a detailed account of how one CPI firm, The Carborundum Company, reorganized its research and development division. The case is especially valuable since it analyzes the various factors which must be considered in any reorganization, e.g., the firm's corporate assets. Subsequent to the Carborundum illustration, a case describing the reorganization of the marketing department of the Union Carbide Plastics Company is presented.

Despite the fact that the functions performed in the two illustrations are markedly different—engineering and sales, for example—there are substantial similiarities. In both companies, there is a change from organizing for meeting the customers' needs on a product line or process basis to an organization on some other basis. For Carborundum, the change was to establish research groups around various branches of science and not around specific products; for Carbide the change was to establish sales groups on a geographical basis, and not on a customer or process basis. In addition, both firms established staff groups to handle planning and administrative functions. And, finally, it need hardly be emphasized that both reorganizations demonstrate how the same human resources can be rearranged to achieve the objectives of the enterprise more efficiently.

20 Engineering Organization at The Carborundum Company

by Leslie E. Simon

Early in 1956 a reorganization was begun in The Carborundum Company with a view to making more effective use of scientists and engineers, increasing creativity in research and development, and improving the company engineering services.

The Carborundum Company is a medium-size corporation with annual sales somewhat in excess of $100 million. It has approximately 27 divisions, foreign subsidiaries, and foreign affiliates. It is primarily an abrasives company but has lesser interests in super refractories, nuclear metals, and electrical components. In the past three years, it has become a national leader in high-temperature materials.

Several years prior to 1956 the company was organized on a decentralized basis, but decentralization of research, development, and engineering had progressed only moderately. The technical structure consisted of a central R&D laboratory; a staff engineering division; and, with one exception, small, weak product engineering groups in a few of the manufacturing operating divisions.

A study, made by a management consultant firm just prior to 1956, had indicated that the central laboratory was too occupied with the day-to-day affairs of the company to be really creative and that the engineering activities were too loosely organized for optimal effectiveness. Subsequent studies resulted in a three-stage reorganization program.

Stage 1 was to consist of a complete reorganization of the R&D Division along lines corresponding to fields of science and engineering in contradistinction to the existing organization along product lines; it was to extend to the recruitment of key scientists and engineers and to the expansion and re-equipment of the laboratory to enable the R&D Division:

1. To be really creative and do work swiftly through bench-scale operations.

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2. To generate technology for improving current product lines and processes.
3. To generate technology for entirely new products to diversify the company and improve profitability.
4. To develop, pilot-manufacture, and sell these entirely new products until they at least reached the company standard of profitability.
5. To create a staff organization that would see to it that the new technology generated by the central laboratory which was applicable to current product lines and current processes would be passed on quickly to the appropriate divisions for development and exploitation; see to the planning and coordination of the technical work of the operating divisions; and see to their getting appropriate assistance when really needed, but not go to the extent of doing their development work for them.

Stage 2 was to consist of integrating all engineering functions into the R&D structure, thereby placing all technology (research, development, and engineering design) in a single, coordinated, and homogeneous organization. In effect, Stage 2 would result in a Research and *Engineering* Division although the old term, R&D Division, is still retained in company parlance. It was contemplated that Stage 2 could be done swiftly at the conclusion of Stage 1.

Stage 3 was to consist of organizing "technical branches" in all operating divisions of the company that needed them (in some instances two operating divisions of similar character could be served by one technical branch). The managers of the technical branches would report directly to the general managers of the divisions.

Stage 3 would require careful analyses of division objectives, assets, skills, sales organization, and applications of company products. The most effective use of engineers would demand the creation of jobs which would meet requirements yet be susceptible of being filled by men trained in recognized disciplines, the establishment of good channels of communication, and finally indoctrination—even "evangelism." It was contemplated that Stage 3 would require one and one-half years, after Stages 1 and 2, for initial organization and an additional one and one-half years for build-up.

Stage I—Reorganization of the R&D Division

The organizational problem in Stage 1 was not as complex as that in Stage 3 insofar as relations between subdivisions were concerned. In fact, if we can discover, as a result of logical and detailed analysis, just what kind of R&D we need, the parts almost fall into place automatically. Therefore, it is important that we reason from the viewpoint of fundamentals. The reasoning process almost dictates the organization structure except for the straightforward provisions for service echelons such as a patent branch.

Dependence on antecedent research

An R&D division exists in large measure for product development. Product development, to be significant, must represent an extension of current technology; it is wholly dependent upon *antecedent* engineering research. The antecedent research may be either old (having escaped application because of its being unnoticed or because of non-availability of means for its utilization) or quite recent. However, we can expect more fruitful and remunerative results from developments based on *advanced* engineering research because its newness minimizes the chance of prior exploitation. Similarly, advanced engineering research is dependent on the antecedent fundamental knowledge that comes from basic research; this fundamental knowledge may be either bright new knowledge from the current literature, or old, worked-over textbook knowledge. Even though we would ordinarily expect practical implications to be in proportion to newness, older knowledge has frequently given rise to important developments. Thus, the leverage power of really new fundamental knowledge is tremendous because it is subject to two-stage amplification: first, in the engineering research stage where it leads to advanced technology; and second, in the development stage where it can lead to radically different products with demand-creating characteristics.

Relation of corporate assets to new product development

However, the importance of new, fundamental scientific knowledge is not the sole criterion for a program of developing new products. We must also develop a continuous and up-to-date fundamental knowledge of corporate assets and their relation to possible new products. The scientific kind of fundamental knowledge has to do with *how* we go about our work; knowledge of corporate assets with *what* the work shall be—i.e., it gives the key to what areas of scientific knowledge are appropriate to the existing corporate skills, technology, marketing organization, and other assets. It is indispensable with respect to (1) what basic research will be sponsored and what kinds of engineering research will be done and to what extent; (2) what development projects will be established and financed; and (3) what developments will be chosen for pilot-line production, market development, and translation into a product line of the corporation. It should be noted that the development of this type of fundamental knowledge is an economic and business matter.

The development of a knowledge of corporate assets is analogous to development of philosophical knowledge in the sense that the approach to the problem is epistemological—a categorizing to establish the limits and validity of the knowledge required. This is true because the development of knowledge involves abstractions, and abstractions demand careful categorization for ready visualization. Furthermore, it is true because common denominators for evaluating interactions between economics, business, research, development, engineering, and production are very difficult of attainment unless clear-cut categories exist from which we may judge the meaningfulness of our knowledge in the context of our problems. Hence, developing fundamental knowledge for guidance in administering the future growth of a company in a new and profitable product is both one of conforming to the natural evolution of new things and one of placing all important aspects of the company in proper categories in such a way that they can be related to one another.

Sources of fundamental knowledge

Basic research is the key to new knowledge; however, it admits of very little specific direction. We are almost reduced to sponsoring basic research only in those fields of science and engineering that give promise of supporting certain product lines. Therefore, a study of corporate products, skills, technology, traditions, and other resources is a prerequisite to assessing the areas of fundamental scientific knowledge that should be developed. Initially this type of knowledge can be obtained from a study of records and from intensive interviews with the officers of the company and other key persons.

However, such knowledge is ever-changing. The permanent administrator of research and engineering must know the company from top to bottom: its history, its growth, its plants, its people, its processes, but above all the skills and technology that set it apart and give it the character of a unique and specific enterprise. In a large organization these are not easy matters to pin down, and the required knowledge can be acquired only by continuing and intimate contact with all the officers of the company, division managers, and other key personnel.

Thus, in addition to a basic research branch, an engineering research branch, and a new product development branch (which have been implied so far), we also need a vehicle for keeping fundamental company knowledge up to date.

This need was met at Carborundum by creating a Corporate Technical Committee with the vice president for research and engineering as the chairman and with all the division managers and the managers of their development echelons as members or alternate members. In addition, key people from the research laboratories and such company officers as the director of marketing and the controller were included. Prior to each monthly meeting the members and alternate members of the Corporate Technical Committee are furnished with copies of a prestaffed agenda by a small permanent staff and secretariat. The meetings serve as a forum for the discussion of all matters of major importance that pertain to older products that are not selling well because they do not have an advantage in technical characteristics over the competition, to newly developed products that have reached the stage when marketing plans must be made, or to future products that we would like to develop for sale. These discussions promote understanding on the part of the divisions of what research and development is doing that may affect them, and they foster an understanding on the part of R&D personnel of the aims, purposes, abilities, and limitations of the manufacturing operating divisions. The committee is a cogent answer to the problem of adequate communication in these days when both oral and written communication are beginning to fail us. The Corporate Technical Committee (familiarly known as the CTC) is regarded with approbation by every echelon of the company.

Mapping a company

The knowledge gathered from intimate communication with all sections of the company played an important part in enabling us to draw a map, so to speak, of the boundaries of promising areas for expansion of the company. If a company is devoted primarily to a certain field of technology and the vast majority of its plant, equipment, and people are steeped in this technology and its supporting fields of science and engineering, that company cannot embark upon some markedly different enterprise without incurring substantial risks. Its best fields for exploitation are the traditional areas of technology and those new areas which are at least related to its existing skills and physical and intellectual assets. Thus, a study of Carborundum gave us the ability to draw boundaries inside which the company appeared to enjoy peculiar advantages with respect to products for sale and outside which it would have to operate at a competitive disadvantage. Of course, we should point out that this mapping process included some knowledge of competitors, financial and marketing trends, and other supporting knowledge, but this type of knowledge also came from those sources already discussed. The information provided by the map was, of course, dichotomous in nature—i.e., it consisted of a categorization which resulted in one of two instant answers: either we should give serious consideration to the exploitation of Proposal A, or we should not consider Proposal A unless its sponsor could give cogent reasons why it should be an exception to the limitations imposed by the map. The corporate map, with some variation in format, was approved by the Board of Directors and is in the hands of all key persons from branch managers to members of the board of directors. This aid to clear-cut policy lessens the frequency of poor or vague decisions and thereby contributes to the more effective use of engineers.

Organization of the Research and Engineering Division

Let us glance at the resulting structure of the Research and *Engineering* Division, first as an organization chart and second as a flow chart of technology.

Exhibit 1 shows the organization. The bottom row of boxes represents the orderly progression: basic research, engineering research, new product development. Of course, the output of technology from the Engineering Research Branch splits: that which pertains to entirely new products goes to the New Products Development Branch of the R&E Division; that which pertains to product improvement, process improvement, or to new products similar to existing products goes to the technical branches of the operating divisions. The operating divisions have the full responsibility for the improvement of their product lines. The R&E Division has the full line responsibility for new products (new enterprises) and the staff responsibility for all other research and engineering matters.

The middle row of boxes denotes services rendered both to the branches of the laboratory (shown on the bottom row) and to all operating divisions.

The top row of boxes shows pure staff work: planning, coordinating, and communicating. The Office of Projects Coordination must issue, before the beginning of a calendar year, a complete plan and schedule of all technical activities of the company which is consistent with the personnel available (or planned to be available) and the budget.

Exhibit 2 also reflects the organization of the R&E Division but from the viewpoint of the flow of scientific and engineering technology and communications. Stages 2 and 3 have been anticipated.

In the operating division, only the technical branch and a manufacturing branch are shown. If the division is multi-plant or has multiple product lines, the same elements apply. Likewise, only the departments of the manufacturing branch that are directly concerned with the flow of technology are shown. Exhibit 2 envisions three strata with the flow of tech-

Exhibit 1. *Organization of the Research and Engineering Division*

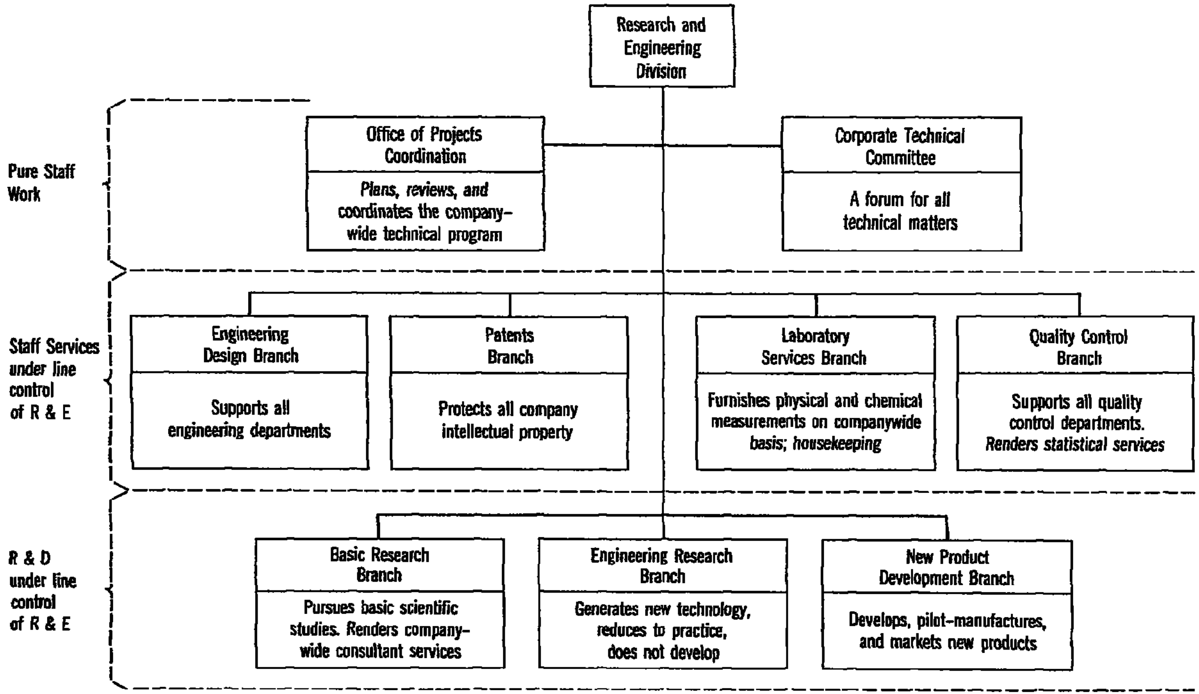
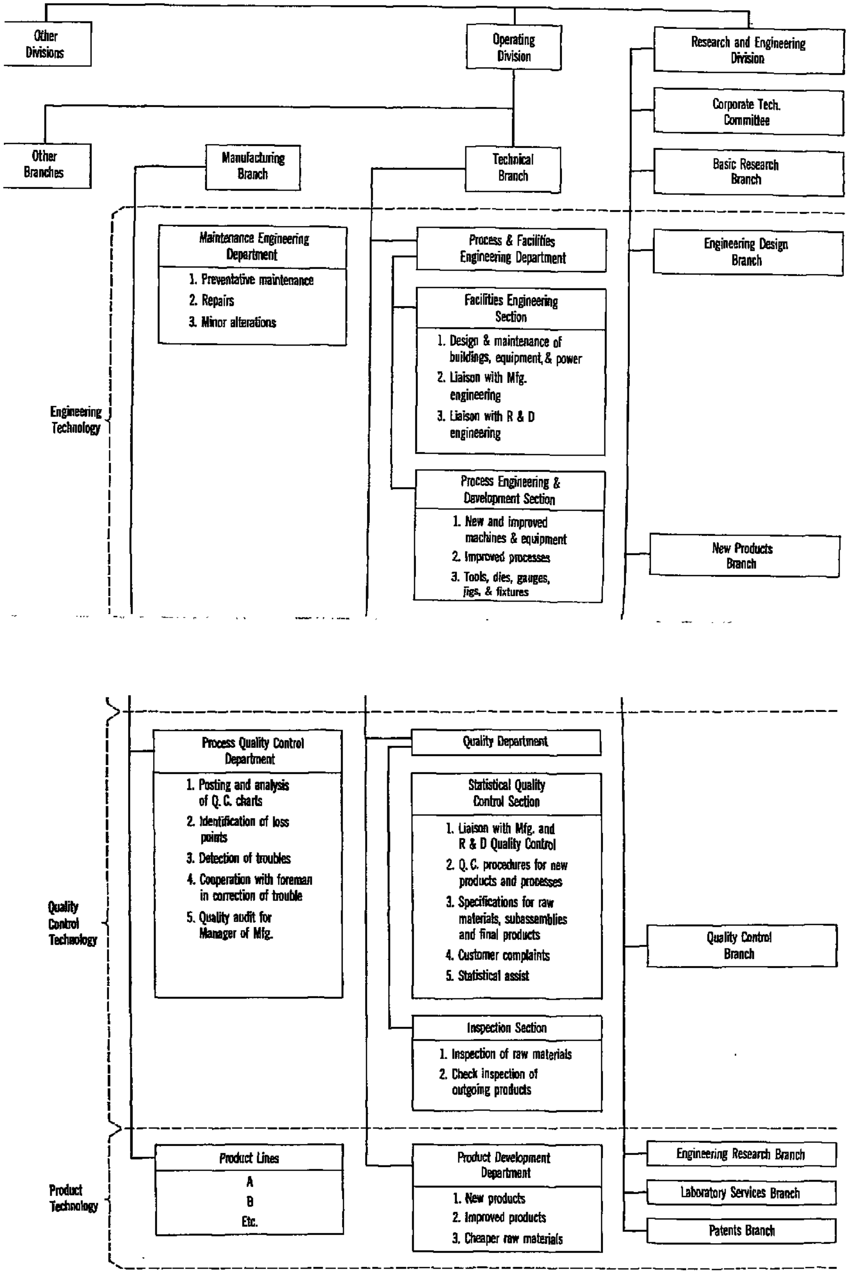

Research and Engineering Division
Pure Staff Work
Office of Projects Coordination
Plans, reviews, and coordinates the company-wide technical program
Corporate Technical Committee
A forum for all technical matters
Staff Services under line control of R & E
Engineering Design Branch
Supports all engineering departments
Patents Branch
Protects all company intellectual property
Laboratory Services Branch
Furnishes physical and chemical measurements on companywide *basis; housekeeping*
Quality Control Branch
Supports all quality control departments. *Renders statistical services*
R & D under line control of R & E
Basic Research Branch
Pursues basic scientific studies. Renders company-wide consultant services
Engineering Research Branch
Generates new technology, reduces to practice, does not develop
New Product Development Branch
Develops, pilot-manufactures, and markets new products

Exhibit 2. *Flow of scientific and engineering technology in a multi-division company*


Other Divisions
Operating Division
Research and Engineering Division
Corporate Tech. Committee
Other Branches
Manufacturing Branch
Technical Branch
Basic Research Branch
Engineering Technology
Maintenance Engineering Department
1. Preventative maintenance
2. Repairs
3. Minor alterations
Process & Facilities Engineering Department
Engineering Design Branch
Facilities Engineering Section
1. Design & maintenance of buildings, equipment, & power
2. Liaison with Mfg. engineering
3. Liaison with R & D engineering
Process Engineering & Development Section
1. New and improved machines & equipment
2. Improved processes
3. Tools, dies, gauges, jigs, & fixtures
New Products Branch
Quality Control Technology
Process Quality Control Department
1. Posting and analysis of Q. C. charts
2. Identification of loss points
3. Detection of troubles
4. Cooperation with foreman in correction of trouble
5. Quality audit for Manager of Mfg.
Quality Department
Statistical Quality Control Section
1. Liaison with Mfg. and R & D Quality Control
2. Q. C. procedures for new products and processes
3. Specifications for raw materials, subassemblies and final products
4. Customer complaints
5. Statistical assist
Quality Control Branch
Inspection Section
1. Inspection of raw materials
2. Check inspection of outgoing products
Product Technology
Product Lines
A
B
Etc.
Product Development Department
1. New products
2. Improved products
3. Cheaper raw materials
Engineering Research Branch
Laboratory Services Branch
Patents Branch

nology: engineering technology, quality-control technology, and product technology. The flow is from right to left, with feedback flow from left to right. It is the feedback of information from the operating divisions to the R&E Division that enables it to guide its activities, and to shape its planning so as to best serve the company. Furthermore, emphasis on horizontal flow should not lead to undervaluation of the importance of vertical flow of information up and down through the technical branch of the operating division and from basic research down to development in the R&E Division.

The Stratum of Engineering Technology. The Engineering Design Branch of the R&E Division is staffed to serve, guide, and assist its counterpart in the operating divisions. The extent of its services to any specific division is dependent on the size, facilities, and capabilities of the engineering design department in that division. This department also serves the production lines in the manufacturing branch. However, the manufacturing branch cannot expect the technical branch to come in and do such things as oiling its machines. It must do a modicum of engineering work such as preventive maintenance, repairs, machine adjustment, and minor alterations. Hence, engineering technology flows horizontally from Research and Engineering through the technical branch to the production line. However, for Research and Engineering to fulfill its complete staff responsibility there must also be a flow of data from the technical branch of the operating division to the Engineering Design Branch of the R&E Division. For, with decentralization, there must still be central control in order that uniformity of practice, methods, and procedures may be realized. Furthermore, company plans and objectives can best be formulated and achieved when the staff divisions are fully cognizant of the operating divisions' activities and desires.

It is the objective of the New Products Development Branch of the R&E Division to feed upon technology from the Engineering Research Branch (this is an illustration of vertical flow of technology within an organization); to develop new products that are *unlike* any that the company makes; to put them through the pilot-line stage; to market them; and to turn them over to an operating division as a going and profitable operation. This means, of course, that process engineering must flow horizontally from the New Products Development Branch of the R&E Division to the engineering design department of the technical branch in the operating division and thence to the manufacturing branch.

The Stratum of Quality Control Technology. The role of quality control, as envisioned in Exhibit 2, probably requires a reappraisal of the usual concept of quality control. As implied here, it includes all safeguards of best and most uniform quality at lowest price from raw material to customer use. This is an area which is often neglected in American industry. Common deficiencies include: failure to have valid and economic specifications for raw materials and a proper system for their inspection and acceptance; poor delegation of responsibility—for example, the manufacturing division is often permitted to produce the specifications for its own products and then to perform the final inspection of its own work. In an industry that enjoys the advantages of uniqueness or of entirely new products, such advantages may offset neglect of the search for economies; but in highly competitive old-art industries where making a product a little better for a little less can spell the difference between success and failure, no avenue toward the economic control of quality of the manufactured product can be neglected.

The Quality Control Branch has four primary functions: (1) operations research (this is a service to the president); (2) quality assurance—i.e., assessment of the general quality level of company products and comparison between the quality of like products made by different divisions of the company and with those of competitors; (3) process quality control—i.e., the design of quality control systems for the operating divisions plus design of experiment; (4) specifications for completed new products and for intra-company products. In addition, the Quality Control Branch should render technical service to the Quality Control Department of the manufacturing division. As a means of assessing general quality level, the manufacturing branch receives an independent check by the technical branch, made for the general manager of the division, and the division receives an independent check by R&E made for the president of the company.

The Stratum of Product Technology. It is the stratum of product technology on which major attention naturally focuses. The generation of product and process technology is the primary objective of the whole Research and Engineering Division. Product technology derives primarily from the Engineering Research Branch of the Central Laboratory. When the Engineering Research Branch has demonstrated that a certain product is feasible, the technology flows to the New Products Development Branch (vertical flow within the division) if the product appears to be markedly different from those under current manufacture; or to the product development department of the technical branch of the appropriate operating division (horizontal flow) if the product is a mere extension of existing product lines.

Of course, all new products or improved products could be developed in the Central Laboratory. However, experience shows that development is best when conducted close to the manufacturing process. Not only does proximity to manufacture lend realism and practicality to the development, but this procedure is both consistent with the principle of decentralization and economic.

The development department in a division must contain people who can communicate with the R&E Division and with the outside world; they must be able to read the literature in a day and age when technology has advanced very rapidly and the literature of all technology has become more and more mathematical. As people in electrical communications say, there must be a matching of impedances or there is no communication. Hence, the people in the development echelons must appropriately match the people in research in order that intelligent communication may lead to "cashing in" on ideas that flow horizontally. This system makes for effective use of highly paid people at each level.

The flow of technology from the Laboratory Services Branch to the divisions consists principally of physical and chemical measurements. Manifestly, the procurement of modern and expensive instruments and the maintaining of competent people to operate them should be confined to one locality but serve all. The flow of services in the Patents Branch is obvious.

Conclusions

Stripped of its details, the philosophy of Stage 1 is simple: it is merely a matter of logically grouping things by categories.

1. Decentralization results in the establishment of "profit centers," or quasi-autonomous divisions.
2. These divisions are vertical organizations or bundles of vertical organizations having operational or line-function categories.

3*a*. Managerially we knit together the operational categories by means of functional staff categories such as finance and industrial relations.

b. The present play follows this tried and proven method and improves the economy and unity of the company organization by extending a similar cohesive net of R&E staff categories over the operating divisions.

4. This procedure enables the company to function efficiently from the viewpoint of innovation by making the most economical and effective use of research and engineering personnel.
5. It also minimizes the generally ineffective practice of trying to develop "vertical men" who, by virtue of long experience, are supposed to supply personally the technology of all the fields of science and engineering for a specific product line. Instead, the managers of a product line can concentrate on management while the required technology for all product lines of the division flows horizontally from the division's technical branch.

21 Union Carbide Plastics Company

by Ralph Westfall and Harper W. Boyd, Jr.

Union Carbide Plastics Company was part of the Union Carbide Corporation, the second largest chemical corporation in the United States. Union Carbide Plastics Company had annual sales of $220 million, which made it one of the largest segments of the parent corporation, the total sales of which exceeded $1.25 billion. The company's marketing organization consisted of eight divisions divided on the basis of markets. In 1957 management was studying this organization and considering a complete reorganization of the company.

Exhibit 1 shows the organization as it existed. The sales vice-president supervised four general sales managers, each of whom had responsibility for two customer-process divisions. While these divisions had products designed for different uses, such as bonding, laminating, and molding, the plastics used were not mutually exclusive; that is, the bonding division used some of the same plastics that were used in the laminating and molding divisions. The management believed that each of these customer-process groups had peculiar marketing problems, and therefore a separate sales force was organized in each division.

The headquarters of all eight divisions were located in New York City. The sales forces varied considerably by size, from as few as six salesmen in the flexible packaging materials division to forty salesmen in the molding materials division. Those divisions that had a larger number of salesmen had several assistant sales managers, and in the molding, sheeting, and surface coatings divisions there were several zone managers who were responsible for specified geographical areas and among them, in each division, covered the entire market area of the United States. Generally speaking, all field sales management personnel, that is, general sales managers, sales managers, assistant sales managers, and zone managers,

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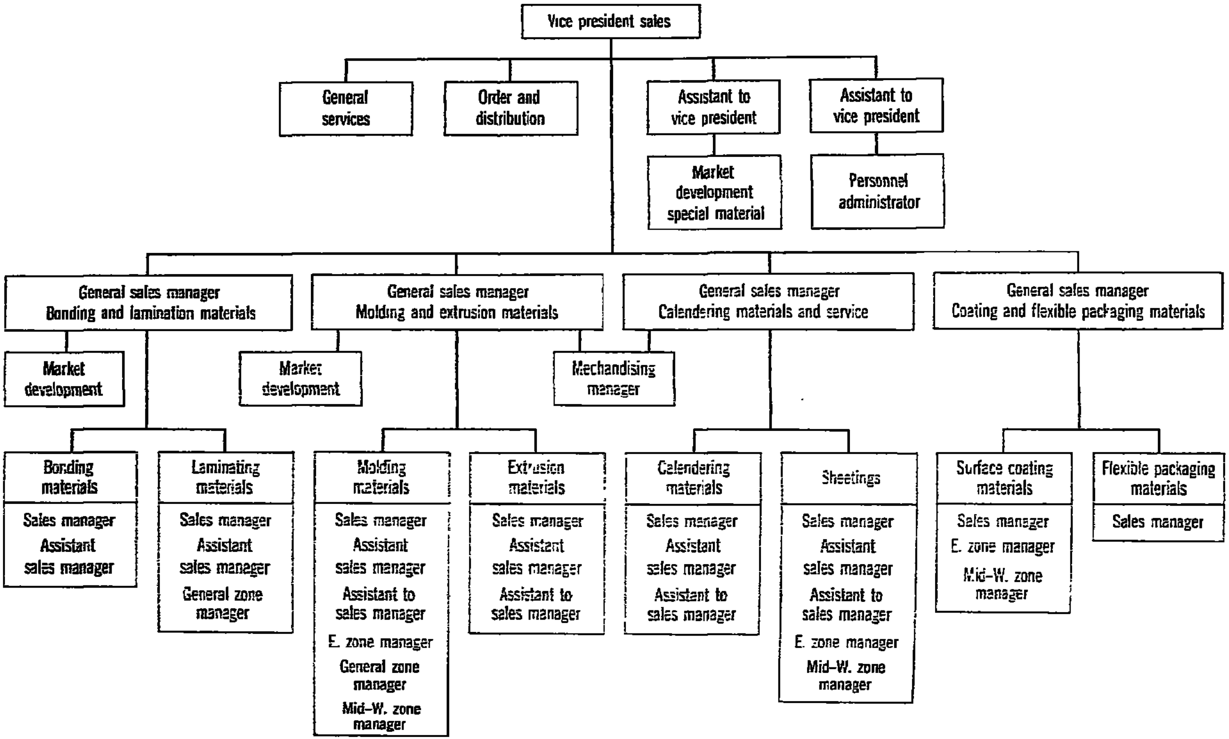
Reprinted with permission from *Cases in Marketing Management* (Homewood, Illinois: Richard D. Irwin, Inc., 1961), pp. 347–351. The authors are Professors of Marketing at the School of Business, Northwestern University.

Exhibit 1. Marketing organization, Union Carbide Plastics Company: 1959



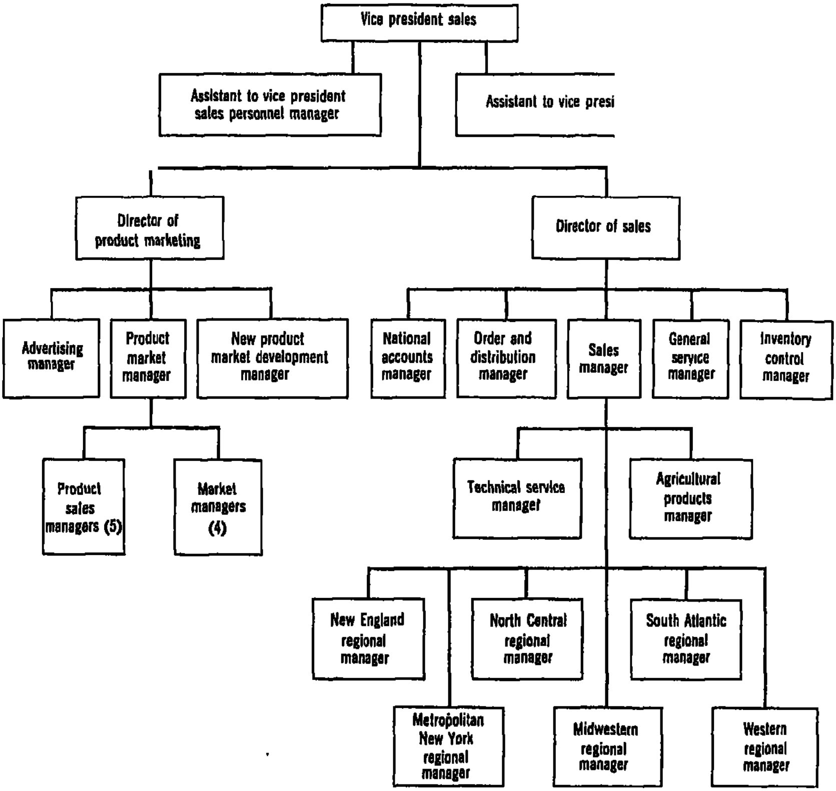
spent about half their time on actual supervision and about half in market and product planning.

The salesmen were highly skilled sales engineers, who rendered a great deal of technical advice and service to their customers. On the average, each salesman had about fifty accounts, some of which were quite large; it was not unusual for accounts to purchase over $100,000 annually. The customers were all manufacturers who used plastics in their products. While continuing relationships with these customers were the usual thing, purchases were made on the basis of one or a few months' needs at a time, so that several purchases were made by each customer during the period of a year. Salesmen spent almost all their time working with established customers. Relatively little prospecting for new customers was done.

In studying its organization, the Plastics Company management became convinced that there were areas for improvement as follows: (1) It was becoming increasingly difficult for the various sales managers to do the two general types of work that they were expected to do—that is, supervise and plan. Management believed that there would be advantages in separating the activities—having one person concentrate entirely on planning and another on supervising. (2) Because of the time spent in planning, sales managers were not giving salesmen as close supervision as they should. Management believed that considerably closer supervision was necessary. (3) Marketing decisions were often made too far away from the actual point at which the problems arose. Since management was mostly concentrated in New York City, problems tended to gravitate there for solution. As a result, people making decisions often had little firsthand knowledge of the problems involved, and a good deal of time elapsed between the recognition of a problem and an actual decision. Such a simple thing as an adjustment of a customer's complaint often had to go to New York City for decision. (4) The existing organization also separated management from customers by too wide a gap. In some cases, customers had no contact with anyone in the Plastics Company except the salesman. As a result of such a situation, a great deal of authority and responsibility remained in New York City; very little was decentralized anywhere in the field.

The proposed new organization, shown in Exhibit 2, separated the direct selling from the planning activities. Under the vice-president of sales two divisions—a direct selling group (line sales) and a planning group (product marketing)—were established. Line sales included a number of the old staff positions that had reported to the vice-president of sales and included six regional offices that would report to the sales manager, who, in turn, would report to the director of sales. Each of the six proposed

Exhibit 2. Proposed marketing organization, Union Carbide Plastics Company


Vice president sales
Assistant to vice president sales personnel manager
Assistant to vice presi
Director of product marketing
Director of sales
Advertising manager
Product market manager
New product market development manager
National accounts manager
Order and distribution manager
Sales manager
General service manager
Inventory control manager
Product sales managers (5)
Market managers (4)
Technical service manager
Agricultural products manager
New England regional manager
North Central regional manager
South Atlantic regional manager
Metropolitan New York regional manager
Midwestern regional manager
Western regional manager

regional managers would have complete responsibility for the sale of all Plastics Company products in his region. All the salesmen in that geographical area would report to this regional manager. The salesmen would no longer be divided strictly along customer-process lines. Some would probably remain specialists in one customer-process line, while others would probably handle more than one customer-process line. It would be up to the regional manager to assign salesmen in the way that he thought best suited his region.

The product-marketing operation, a staff function and the second of the two major proposed groups reporting to the vice-president of sales, was divided into three parts: advertising, product market, and new product market development. The product market manager would have two types of managers reporting to him. One included a group of five product sales managers and the other a group of four market managers. The product sales managers were to be divided according to basic plastic products, such as phenolics and vinyls, and the market managers according to the major markets served by the company, such as flexible packaging, flooring, and sound records. By developing expertness in their assigned product or market areas and by working closely together, the product sales managers and market managers would support line sales in such a manner that the selling effort would be aimed at maximizing sales profits on all established products in all established markets. The product sales managers' primary responsibilities would be to represent sales to other departments, such as production and development, and to plan for the availability of the right products in sufficient quantities, properly priced, and of proper quality to meet customer needs and maintain company profits. The market managers' primary responsibilities would be to plan marketing programs to be implemented by line sales, to assist the management of advertising in planning and developing promotional and advertising programs, and to participate actively in the industry associations of customers.

The functions of the new-product market-development group would be the same as for the product market operation except that it would deal with new products in old and new markets rather than with the established or existing products and markets. Its objective would be to introduce and develop new products and new market opportunities to the point where they were commercially established and the planning functions on these products and markets could be turned over to the product market operation, thereby permitting new product market development to move on to other new products and markets.

Should the proposed organization plan be adopted?

What does a firm do to get established in a new product line? How is the organization assembled? It is not sufficient for the firm's management to allocate funds for the venture and to hire personnel for the task. The funds must be properly budgeted, and the activities of the new personnel integrated to serve a common end.

The following case describes the activities undertaken by Spencer Chemical Company in the early 1950's to build a marketing organization for what was to Spencer a new product: polyethylene. Although the case deals with several aspects of establishing this venture, e.g., market research, advertising, and sales training, the central theme which brings these activities together is the close coordination required of the individuals involved. Thus, the case study points out quite clearly just how dependent an enterprise is upon the successful cooperation of its personnel.

22 Building a Marketing Organization

by Robert W. Schramm

Early in the fall of 1951, Spencer Chemical Co. had available a source of high ethane gas. A general economic appraisal was started to determine which chemicals in the ethylene chemistry field offered the greatest promise. This marked the initial study of polyethylene as a potential product for the company.

These studies lead to a recommendation to Spencer's board of directors in May 1952 that research consideration be given to the development of a polyethylene process and that other ethylene chemicals be studied to provide a general knowledge of ethylene production and handling. In mid-September a detailed report which suggested ethylene expansion was presented to the administrative committee.

About one month later, Imperial Chemical Industries announced that it would license its process for polyethylene manufacture in the United

Chemical and Engineering News, Vol. 34 (January 30, 1956), pp. 462–466. Copyright 1956 by the American Chemical Society and reprinted by permission of the copyright owner. Mr. Schramm is now General Manager of Development for the Southern Nitrogen Company, Inc.

States and in late October the initial meetings between Spencer and ICI's representatives took place. These negotiations continued until Spencer signed the first license agreement with ICI in the first week of March 1953. This agreement was ratified by Spencer's board of directors in the same month.

900 Field Interviews

Shortly thereafter, Spencer formed a five-man polyethylene survey team recruited from market research, technical service, and industrial chemical sales departments of the sales division, and from the development department of the operations division. This team was in the field for some four months and made nearly 900 field interviews, calling on people primarily connected with polyethylene in processing, use, and equipment. The result of these interviews was a polyethylene survey report of approximately 150 pages covering the product, the relationship of its properties to its uses, processing, process equipment, research and development, and marketing. While it did not answer all possible questions concerning polyethylene resins, it did answer a great many of them. In addition, it served as an outline for planning the attack on the remaining problems.

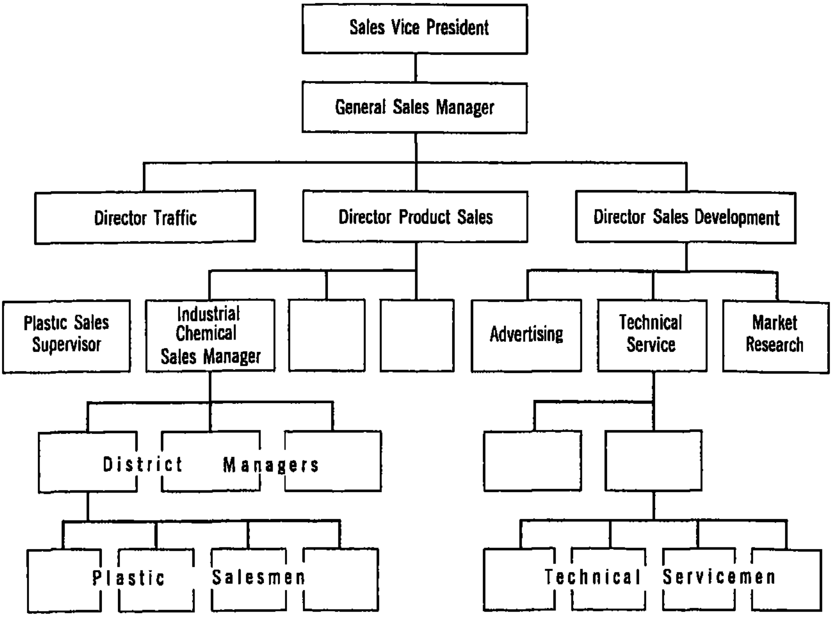
Immediately Spencer's research, engineering, and production people began to study the problems that faced them. Their work was coordinated with the sales division.

With any new product line, marketing can be attempted by one of three ways:

1. Add the new product to your present system.
2. Build a complete new system for the new product entirely separate from the existing system.
3. Overhaul the present system so that it can handle the unique features of the new product.

Plastic Sales

To this end, a study was made of general plastic sales operations, covering not only other polyethylene sales forces, but also the entire field of thermoplastics as well as thermosetting resins. From this study Spencer determined that its polyethylene sales and technical service combined with its existing industrial chemical sales organization would best do the job.



Spencer polyethylene sales organization.

The industrial chemical sales manager secured a staff assistant to aid in the coordination of polyethylene sales. Each of the district sales managers was to serve a dual role for industrial chemicals and polyethylene. An assistant manager of technical service was appointed to direct polyethylene technical service. From the previous studies, qualifications were established for the type of salesman and technical service man that was most beneficial and acceptable to potential customers.

These men then set about to find or develop men that would complete their sections. Again the previous studies were used to determine the number and location of accounts. By ratioing accounts, number of calls, and distance, it was determined that initially eight field salesmen were needed in addition to the district managers and the staff members, and four technical service personnel.

It was decided that these first sales people could best function if they were located thus:

Boston	1
Ohio Area	1
Kansas City	2
New York	2
Chicago	2

The needs of technical service could be best served by locating one representative in New York, one in Chicago, and two in Kansas City.

While this new sales and service organization was being assembled, there were two other areas that were quite active. These involved establishment of an applications laboratory for the training of new personnel and an advertisement program to introduce the company name and material.

It was soon apparent that Spencer was not a known name in the plastics industry. While it did produce formaldehyde for thermosetting resins, company sales were to plastics producers rather than raw plastics consumers.

"Get Acquainted" Campaign

Immediately after signing with ICI, over 400 telegrams were sent out to announce Spencer's entrance to the trade. Shortly thereafter a letter from the sales vice president went out to all the plastic consumers that we could locate by address. It told them of the company's intentions and asked that they complete a check-list postcard that was enclosed. This was the beginning of the growth of mailing lists, as well as the basis for the original field survey. After the completion of the initial field survey mentioned before, the general sales manager sent a letter (Oct. 16, 1953) to each active or potential polyethylene user that was discovered. This general letter "to get better acquainted" included a reprint of a story about Spencer from an industrial publication. At Christmas, Spencer Chemical wished the entire industry the season's "best wishes."

With the coming of the new year (1954) the campaign was stepped up. The second of the "get acquainted" letters was sent out by the director of product sales with a preprint of a regular *Time* advertisement that carried a reference to Spencer's entrance into polyethylene in a "secondary spot."

This secondary spot in *Time* was carried approximately once a month for the next six months, in each case showing such applications of polyethylene as squeeze bottles, packaging material, and coaxial cable covering.

While public announcements were being stepped up, Spencer began to acquire the needed outside personnel, and the airways between Kansas City and London were kept busy as various teams went about acquiring all the information available from ICI. During February the first of many polyethylene sales seminars was held. From this meeting came a projected polyethylene sales promotion schedule and the decision that a trade-mark and a trade identification symbol would be beneficial to the sales program.

The March direct mail piece was a letter from the general sales manager and included a gatefold with head and pen sketch of most of the people involved with polyethylene, including the vice president, sales; general sales manager; direct of product sales; sales manager, industrial chemicals; director of quality control; plant manager of Orange works; manager plastics laboratory; director of traffic; credit manager; technical service; polyethylene sales service; market research; and the advertising manager.

During April a letter was mailed from England telling of the company's technical teams and enclosing snapshots of groups examining polyethylene articles and at different places at ICI.

In late April announcements were mailed of the appointment of the polyethylene sales supervisor, followed by the announcement of the manager of the plastic applications laboratory.

In May the direct mail carried an invitation from the manager of industrial chemical sales to visit the Spencer booth at the National Plastics Exposition in Cleveland to get acquainted with Spencer people and perhaps be the subject of a caricaturist. Also in May, Rand-McNally road atlases were sent out with a note for vacation plans.

The letter that went out in June had pictures of eight pretty girls that work in the Kansas City office, showing their reaction to a proposed advertising idea as presented by the director of product sales.

In August the trade-mark and symbol were announced by sending out a shirt pack with each letter from the director of product sales.

A Pig-Tailed Blond

When the decision to make use of a trade-mark and symbol was adopted, it was also decided that it should be some likeness that could be used to demonstrate the properties of polyethylene. The selection of a character was a long process. The name selected, Poly-Eth, naturally suggests a girl, so rough art was done on a series. The idea was even carried forward to illustration and layout. But, alas, it seemed that the old Poly-Eth did not have the adaptability that a younger model might be expected to display, therefore, she had to give way to a very versatile little pig-tailed blond that now is found on all Spencer's ads.

From the beginning it was recognized that to be successful it would be necessary to have close coordination between all those concerned with the polyethylene project. First a steering committee was set up with the manager of market research as the chairman, and the director of sales development, the director of products sales, and the general works manager as members. This committee functioned through the writing of the first survey report. Then it was replaced by a coordinating committee composed of the general manager of research and development as chairman, the assistant to the general sales manager as secretary, and representatives from the research department, plastic laboratory, technical service, market research, sales, engineering, production, and technical control.

This committee met at regular intervals to consider any questions in the polyethylene field which need discussion or coordination among the various groups represented. In turn, it was divided into small subcommittees responsible for specific operations. One of the most active of these groups was in charge of orientation—actually two operations.

In the first part, a member of the general sales manager's staff is assigned to see that new personnel are properly introduced throughout the company. In a series of rotating assignments they become acquainted with the functions of all the major departments and sections of the company. They also are indoctrinated with the history, philosophy, and policies of the company.

Orientation Course Set Up

In late June a polyethylene orientation course was set up. This consisted of eight lectures, two and a half hours in length, two per day, once a week, for a month.

This course was given in two sections, one at the Jayhawk plant and the other in the Kansas City offices. At the plant operating, engineering, and research personnel were reached, and in Kansas City it was given to sales, technical service, development and plastic laboratory personnel. The course was to fill in and round out the background for all those who would have contact with the program.

From the first survey, it was determined that if Spencer was to keep pace it would be necessary to have a plastics application laboratory. In the late fall of 1953 plans were laid for the creation of such a laboratory.

A building was available that had served as the company's Kansas City warehouse. It was well located and could be adapted with a minimum of structural rearrangement. It was divided into three areas: administrative, production equipment, and testing facilities.

Actual production size equipment was installed to provide for operating experience for our personnel, an opportunity to make comparative tests on competitive material, and to aid in customer service. The testing area was equipped to make all standard specification tests, and to test the quality of performance in application tests.

Polyethylene Orientation Course

Lecture I

Orange Plant Description and Layout

- *a.* ICI background
- *b.* Simplified flow sheet
- c. Some of the plant details
- *d.* Equipment (discussion of major pieces)
- e. Size and capacities
- f. Discussion of problems
- *g.* Questions and answers

Lecture 2

Plant Operation

- *a.* Plans for plant start-up
- *b.* Expected operating problems (maintenance, etc.)
- c. Relationship of process variables with product quality
- *d.* Plant control problems (decompositions, etc.)
- e. ICI background
- f. Questions and answers

Lecture 3

Quality Control

- *a.* Description of product
- *b.* Types of tests conducted on plant product and frequency of tests
  - (1) Control tests
  - (2) Specifications
- c. Blending and homogeneity
- *d.* ICI background
- e. Questions and answers

Lecture 4

Product Processing

- a. Compounding
- b. Methods and equipment for making the finished polyethylene product (this includes extrusion, molding, casting, etc.)
- c. Questions and answers

Lecture 5

The Function of the Plastics Laboratory

- *a.* Questions and answers

Lecture 6

The Sale of Polyethylene

- *a.* Sales plans and organization (a short resume)
- *b.* Discussion of sales problems (how plastics sales differ from other chemical products)
- c. Sales problems (competition, established sales territories)
- *d.* Publicity and advertising
- e. Market research
- f. Questions and answers

Lecture 7

Technical Service

- *a.* Functions of technical service (the customer and his problems)
- *b.* Problems and philosophy
- c. Competing plastics
- *d.* Ultimate end uses (bottles, sample kitchenware, film, and pipe, etc. displayed)
- e. ICI background
- f. Questions and answers

Lecture 8

Research

- *a.* ICI background
- *b.* Summary of research's aims and responsibilities
- c. Present work, equipment, drawings
- *d.* Pilot plant work
- e. Copolymers and alloys
- f. Technical information (types available)
- *g.* Questions and answers

Customer Contacts Maintained

To prevent laboratory personnel from becoming "ivory tower" in their approach to problems, fairly frequent customer contacts are maintained in cooperation with sales and technical service. Society memberships, convention attendance, and technical paper publications are encouraged.

In the short-range program it is hoped that a standard training course will become a routine operation at the plastics laboratory and function as a service to all departments. It is estimated that a general sales trainee will be given two weeks in the application laboratory and that new research personnel be given two months in the laboratory. For polyethylene sales personnel, a training period of three months has been suggested, with a two-weeks refresher course once every year thereafter; for technical service personnel, the training period will be six months, and a combination refresher course and special project study will be made twice a year for a period of two weeks.

The short range program was set up for the first week of orientation to cover the operations of compounding, extruding, molding, and the use of physical test equipment. The second and third weeks include teaching the techniques of equipment operation to the trainees, including compounding, extruding, molding, and running necessary physical and chemical tests. The fourth through the eighth weeks involve studies of problems of a general nature. After this, special studies are made.

As trainees advance, continuing seminars are held and reports written so that their experience will be available to all. These training reports are for use by following groups and are a continuation of the beginning report. A significant report is the joint one issued by the sales, technical service, and research group who visited England.

Spencer's attack on the problem of building a sales and service organization has been one of continuing forecasting of uses, markets, and accounts to determine needs and to try to outguess trouble. When the decisions are reached and the goals established, they are circulated throughout the company to the sales, operations, and finance divisions to make sure that they are understood and coordinated.

The *Dictionary of Occupational Titles* prepared by the United States Employment Service contains definitions of 22,028 jobs. A *job* may be considered to be a work assignment having a specific set of duties, responsibilities and conditions different from those of other work assignments.

Job descriptions serve a variety of purposes and are indispensable to the effective functioning of the enterprise. Aside from serving the obvious end of informing the holder of a position exactly what it is that he is supposed to do, the job description can be used to: draft organizational charts and manuals, estimate budget requirements, install wage incentives, rate the employee in terms of how well he meets the specifications set forth in the job description, train the employee, guide the selection, transfers and promotion of personnel, etc. The job description is a description of the *job* and *not of the individual* who happens to hold that job.

Job descriptions are not used effectively in the industrial world, and this includes the chemical process industries. Most of the small firms do not have them; the major users of job descriptions are the bigger CPI firms—those with sales exceeding 50 million dollars. Even among the latter, their use is often neglected or relegated to certain top management echelons. It is commonplace for chemists and engineers to be completely unaware of the fact that there is such a managerial tool as a job description of his work, even when one exists (often reposing in the dead files of the personnel department).

Although misused and neglected, the job description is both an important managerial tool and a vital aid for the self-development and conduct of the jobholder. The following pages give examples of job descriptions extant in several CPI firms, Carborundum and American Enka, for example. They cover the gamut of positions from Chairman of the Board of Directors to Group Leader. Although the form may vary considerably from company to company, the general content remains fairly uniform. Thus, the job descriptions usually contain statements of the functions, scope, purpose, duties, responsibilities, organizational relationships, limits of authority and working conditions involved, and comments clarifying the foregoing.

23 Koppers Company, Inc.:

Chairman of the Board of Directors

by C. L. Bennett

Basic Function

To preside at all meetings of the Board of Directors; to advise and counsel with the President and with other officers of the Company; and to perform such other duties as may be assigned to him by the President and the Board of Directors.

Scope

The duties and responsibilities of this position extend to all activities in which the Company may engage.

Duties and Responsibilities

1. To preside at meetings of stockholders and directors.
2. To participate jointly with other members in the broad direction of Company affairs, by reviewing and deciding upon matters which exert major influence on the manner in which the Company's business is conducted. Such matters include, but are not limited to:
   - *a.* Establishment and revision of By-Laws.
   - *b.* Election of officers of the Company.
   - *c.* Approval of plans and programs.
   - *d.* Authorization of capital expenditures.
   - *e.* Authorization for disposal of assets.
   - *f.* Approval of borrowing and other plans to finance Company operations.
   - *g.* Declaration of dividends on the Company's stocks.
   - *h.* Establishment of whatever controls and regulations may be deemed necessary to proper protection of the rights and interests of stockholders and creditors of the Company.
   - *i.* General supervision of the conduct of the Company's business.

Selections 23 through 28 are reprinted with permission from: C. L. Bennett, *Defining The Manager's Job* (New York: American Management Association, Research Study No. 33, 1958). Mr. Bennett is a staff writer for the American Management Association.

3. To advise and counsel with the President and other officers of the Company on major and difficult problems.
4. To establish and maintain good relationships with governmental units, major stockholders, technical and business associations, and with the public and industry in general.
5. To handle major financial, corporate, and legal matters at the request of the President or Board of Directors.
6. To carry out special assignments as may be requested by the President or Board of Directors.
7. To handle special requests for information from directors of the Company.
8. To generally supervise the activities of the Pension Committee and the Retirement Board.
9. To develop broad basic policies for consideration by the Board of Directors.
10. To evaluate, and recommend to the Board of Directors, policies with respect to executive compensation and employee pension and benefit plans.

Organizational Relationships

1. The Chairman, jointly with other members of the Board of Directors, is responsible to his electors, who are the stockholders of the Company, for the proper discharge of the duties and responsibilities of this position.

Limits of Authority

Through consideration and decision on matters of Company policies, programs, and expenditures, and through election of Company officers, each member of the Board of Directors, in conjunction with each other member, exercises full authority over all aspects of Company operations. The specific authorities of this position are covered in the Certificate of Incorporation and in Company By-Laws.

24

Koppers Company, Inc.:

Member, Board of Directors

by C. L. Bennett

Basic Function

The exercise of prudent business judgment in reviewing, considering, and deciding upon major and basic matters affecting Company activities. General supervision of management's conduct of the Company's business.

Scope

The duties and responsibilities of this position extend to all activities in which the Company may engage.

Duties and Responsibilities

1. To participate jointly with other members in the broad direction of Company affairs, by reviewing and deciding upon matters which exert major influence on the manner in which the Company's business is conducted. Such matters include, but are not limited to:
   a. Establishment and revision of By-Laws.
   b. Election of officers of the Company.
   c. Approval of plans and programs.
   d. Authorization of capital expenditures.
   e. Authorization for disposal of assets.
   f. Approval of borrowings and other plans to finance Company operations.
   g. Declaration of stock dividends.

h. Establishment of whatever controls and regulations may be deemed necessary to proper protection of the rights and interests of stockholders and creditors of the Company.

i. General supervision of the conduct of the Company's business.

Organizational Relationships

1. Members of the Board of Directors are responsible to their electors, who are the stockholders of the Company, for the proper discharge of the duties and responsibilities of this position.
2. The President is responsible to the Board of Directors, jointly, for performance of his duties and responsibilities.

Limits of Authority

Through consideration and decision on matters of Company policies, programs, and expenditures, and through election of Company officers, each member of the Board of Directors, in conjunction with each other member, exercises full authority over all aspects of Company operations. The specific authorities of this position are covered in the Certificate of Incorporation and in Company By-Laws.

25 The Carborundum Company: President

by C. L. Bennett

Other Titles

Director, The Carborundum Company, Niagara Falls.
President and Director, The Carborundum Metals Company, Inc.
President and Director, Canadian Carborundum Company, Ltd.
Director, The Carborundum Company, Ltd.
Member, Board of Surveillance, A/S Arendal Smelteverk.
Partner, Deutsche Carborundum Werke.

General Responsibility

Responsible for "general charge and direction of the business of the Corporation" subject to the Company By-Laws and the "Statement of the Responsibilities of the Board of Directors and President" as approved by the Board of Directors July 1, 1952; functions as a member of the Board of Directors and presides at the meetings of the Board; keeps the Board informed of the activities and progress of the Company; carries out the policies and directions of the Board; responsible for the operation of the Company in a manner which will result in growth in profits, financial stability, essential production facilities, quality and quantity of products, reputation, and equitable benefits to the Company's stockholders, customers, and employees.

II. Organizational Relationships

A. Line
   1. Responsible to the Board of Directors for performance of assigned responsibilities.

2. Responsible for the supervision and performance of the following:

Staff

Executive Vice President.
Assistant to the President.
Secretary and General Counsel.
Treasurer-Controller.
Vice President, Sales.
Director, Manufacturing.
Director, Industrial Relations.
Vice President, Research and Development.
Vice President and Chairman, Management Advisory Committee.
Assistant Vice Presidents.

Line

Vice President, Refractories Division.
Vice President, Bonded Products and Grain Division.
Vice President, Coated Products Division.
General Manager, Globar Division.
Manager, Vancouver Plant.
Vice President, The Carborundum Metals Company, Inc.
Vice President, Canadian Carborundum Company, Ltd.
Managing Director, The Carborundum Company, Ltd.
Managing Director, British Resistor Company, Ltd.
Manager, Deutsche Carborundum Werke G.m.b.H.
Manager, Carborundum Schleifmittel G.m.b.H.
President, Canada Sand Papers, Ltd.
Managing Director, A/S Arendal Smelteverk.

III. Specific Duties

Kind of activity	*Scope*	*Type of action*
A. Line or Operational		
1. Objectives	Company-wide, including subsidiaries	Develops Company objectives for approval of Board of Directors. Promulgates these objectives to serve as basic guide for Company operation.

Kind of activity	*Scope*	*Type of action*
2. Policies	Company-wide, including subsidiaries	Develops and promulgates those policies required to further stated Company objectives. This activity is threefold: *a.* Recommending policies to the Board on matters not delegated by the Board to the President. *b.* Issuing policies, either in furtherance of Board action or on those matters for which responsibility has been delegated to the President; and *c.* Insuring that adequate directives in furtherance of *a* and *b* are issued at staff and operating levels.
3. Organization	Company-wide, including subsidiaries	Insures that organizational structures at all levels of the Company are the most efficient for the type of operations in which the Company is engaged. Plans for changes in organization required to balance with future trends of Company operation. When major re-alignments are contemplated, secures approval of the Board of Directors.

Kind of activity	*Scope*	*Type of action*
3. Organization (*continued*)	Company-wide, including subsidiaries	Selects and assigns qualified personnel to staff key positions of the Company; and delegates authority and responsibility to such personnel.
4. Programs	Company-wide, including subsidiaries	Directs the preparation and coordination of specific short- and long-term programs to cover each major phase of operations to realize established Company objectives. Presents such programs to the Board of Directors for approval.
5. Administration and control	Company-wide, including subsidiaries	Insures that efficient procedures, systems, and methods are established for the Company's operations. Continuously controls all activities of the Company, by checking progress against programs to determine those areas where corrective action is required and initiating such action. Provides policy interpretation and other guidance as required to those staff and line personnel reporting to the President.

Kind of activity	*Scope*	*Type of action*
5. Administration and control (*continued*)	Company-wide, including subsidiaries	Continuously supervises all personnel responsible to the President.
6. Company representation	Company-wide, including subsidiaries	Represents the Company to the public, industry, and government in furtherance of the Company's repuation and objectives. Represents the Company in other companies in which investment has been made.
B. Staff or Functional None		

26 American Enka Corporation: Vice President for Research and Development

by C. L. Bennett

I. Major Function

1. Determines objectives and formulates plans, programs, policies, and procedures relating to research and development, subject to the approval of the President.
2. Assumes responsibility for the foregoing function in order to keep the Company in the forefront in all technological developments affecting the manufacturing processes and the end uses of the Company's products.
3. In the performance of these functions the Vice President for Research and Development will delegate responsibility and commensurate authority; and will develop and train personnel under his jurisdiction for the assumption of more responsible duties.

II. Specific Responsibilities and Authority

1. Directs programs in the Research and Development Division covering experimentation in the development of new processes, new products, and additional end uses of existing products, improvements in quality, increase in production capacity, and reduction in costs.
2. Provides for research and experimentation in all matters that in his judgment appear important in advancing the technological position of the company, including
   - *a.* The improvement of quality and suitability of the Company's product; the reduction of cost and increase of productive capacity.

   b. The investigation and development of new processes, new products, and new uses.
   c. The provision of an adequate amount of exploratory or fundamental research to support, through increased knowledge, the activity in applied research.
   d. The evaluation of the Company's and competitive products for end-use suitability.
   e. The rendering of technical assistance to the Sales and Manufacturing Divisions on problems as required.
   f. The testing and evaluation of certain raw materials.
3. Consults with the General Sales Manager and Vice President for Manufacturing in the development of the Company's research program.
4. Cooperates with the Manufacturing Division in connection with the technical aspects of production and testing of new equipment.
5. Cooperates with the Manufacturing Division and Purchasing Department in matters of quality and testing of materials furnished by the Company's suppliers.
6. Maintains liaison with outside organizations, laboratories, etc., with the objective of obtaining information and knowledge relating to the work of research.
7. Visits customers to obtain information about the performance of the Company's product, with the knowledge of the Sales Division. Analyzes the quality level of the Company's product in comparison with the products of competitors; and initiates action as necessary.
8. Obtains information on the prospects, technical developments, and trends, both present and future, in rayon technology, covering yarn manufacture, consumers' processes, and end-use reaction; and initiates research activity as a result of such information.
9. Conducts periodic meetings of members of the Research and Development Division for the discussion of research objectives, activity, and conclusions, and other matters concerning the operations in the research organization.
10. Conducts periodic research conferences in which members of the Research and Development Division discuss objectives, results, and conclusions of their work for information to the other departments of the Company.
11. Assumes responsibility for developing and maintaining an organization competent to carry out effectively the research and development aims of the Company.

12. Assumes responsibility for developing and administering budgets covering research and patent activities.
13. Reviews all license agreements; and submits recommendations before such agreements are signed by the appropriate official for the Company.
14. Authorizes capital expenditures not exceeding $10,000 with respect to research equipment; and recommends such expenditures in excess of $10,000 to the President.
15. Authorizes the creation of a new salaried position or the filling of a vacancy with the Research and Development Division from outside sources.
16. Recommends to the President the employment of professional services to be rendered to the Research and Development Division.
17. Assumes responsibility for the allocation of space to departments within the Research and Development Division.
18. Authorizes travel for Research and Development personnel directly supervised.
19. Authorizes Company-sponsored memberships in technical and professional organizations for individuals in the Research and Development Division.
20. Assumes responsibility for proper contacts with AKU on research and development matters.
21. Assumes responsibilty for Company patent activities.
22. Keeps abreast of the latest developments in the field of research; and introduces more advanced methods of research management, administration, and control.

III. Relationships

1. The Vice President for Research and Development is elected by the Board of Directors. He is responsible to the President.
2. The Assistant Directors of Research, Chief Patent Attorney, Leader of Research Engineering Section, and Administrative Assistant are responsible to the Vice President for Research and Development.

27

A Large Pharmaceutical Firm: Director of Production, Chemical Division

by C. L. Bennett

Basic Function

To develop production objectives, standards, and programs for the __________ , __________ , __________ , and ____________ plants of the Chemical Division in conformance with Company policies; and to direct and integrate all production, production planning, warehousing, preparation of goods for shipping to plants and branches, and related activities for these plants. This responsibility extends functionally also to the St. Louis blending plant.

Duties and Responsibilities

1. Objectives. Develops objectives, policies, and programs for the production activities of the [four] plants [within his jurisdiction]; and periodically evaluates and reports results.
2. Production Activities. Directs and coordinates all manufacturing, warehousing, preparation of goods for shipment, and related activities, in conformance with approved processes, standards, and sales requirements. Is responsible for seeing that the efficiency of existing processes at all Chemical Division plants (excluding Marine Magnesium) is maintained at the highest possible efficiency.
3. Production Planning. Generally supervises the development and execution of production planning policies, programs, and techniques; and recommends to the Management Council inventory policies and controls. Through his production planning staff and the planning units at the production plants, maintains close liaison with Marketing and other areas concerned to carry out these functions effectively.

4. Standards and Costs. Cooperates with other areas in the Division in establishing and maintaining productivity and cost standards.
5. New Processes. With the advice and guidance of the Technical Area and Engineering, directs the installation and break-in of new processes in the factory units. Cooperates with the Technical Area and with Engineering in the demonstration of new equipment and processes. Jointly with the Technical Area and Engineering, sets final process procedures and yield standards. Recommends process improvements and cooperates with the Technical Area in the development of new processes and process information.
6. Documentation. Directs the documentation and maintenance of factory process information, making certain the process write-ups are kept up to date and reflect approved process changes.
7. Quality Control. As delegated by Chemical Control, and with its advice and guidance, maintains adequate quality control and inspection for in-process materials, intermediates, and materials for re-use. Uses methods and procedures approved by Chemical Control for subdividing and packaging operations of Control-released bulk, and for pharmaceutical formulation operations. Informs Chemical Control, at the time of delivery of a lot, of any deviations from standard manufacturing, formulating, or subdividing practices, and of any unusual circumstances occurring that might be significant from a quality standpoint. Substandard quality and/or unacceptable deviations from approved operational or control practices during manufacturing, formulation, or subdivision may result in rejection by Chemical Control.
8. Custody. Directs the custody and protection of raw materials, containers, products, and process information.
9. Facilities. Sees that production facilities are properly protected, maintained, and utilized, consistent with the best interests of the Company.
10. Licenses and Permits. In conformance with legal requirements, sees that necessary licenses and permits are secured.
11. Capital Expenditures. Authorizes or recommends capital expenditures in the production areas under his direction, in conformance with approved budgets and delegations of authority.
12. Functional Responsibilities. Under the functional supervision of the areas concerned, directs the Engineering Purchasing, Traffic, Industrial Relations, Financial Services, and Public Relations activities in the Chemical Division plants, except the Marine Magnesium Division.

Measurement of Performance

The measures of performance for the incumbent in this position are:

1. The effectiveness of production policies and programs at the [four] plants [concerned].
2. The operating efficiency of existing processes at these plants.
3. The successful maintenance and protection of materials and facilities.
4. The effectiveness of cooperative transactions with other areas and Divisions.

Organizational Relationship

1. Reports to the Division President.
2. Provides advice and service to other areas and divisions of the Company as mutually agreeable.

Committee Membership

Chemical Division Operating Committee.

28 American Enka Corporation: Plant Manager

by C. L. Bennett

I. Major Function

1. Formulates and executes plant policies, plans, and procedures subject to the approval of the Technical Vice President.
2. Exercises general supervision over and assumes responsibility for the effective administration of all Company policies and procedures within the Enka plant; translates Company programs into successful operating results; sees that the plant and equipment are properly maintained and that the adequate and trained personnel are available to effectively carry out all plant operations.
3. In the performance of these responsibilities, the Plant Manager will delegate responsibility and commensurate authority and will train and develop personnel for the assumption of more important responsibilities.

II. Specific Responsibilities and Authority

tes, and directs all plant operations, including:
ıance of proper production, quality, and cost

ıance, repair, and rental of plant, equipment,
buildings, company houses, and farms.
; of requirements for raw materials and supplies
ın with the Chief Chemist, Superintendent–Nylon
Director of Processes, and Director of Purchases,
ıblishment of proper stock levels to insure an
ıntity of raw materials and supplies in coopera-
› Director of Purchases.

   - *d.* The receipt, storage, and issue of raw materials and supplies.
   - *e.* Storage and shipment of the finished product.
   - *f.* The analysis of costs, labor, and production data; and steps taken to insure production at proper costs and the effective utilization of personnel, raw materials, supplies, and equipment.
   - *g.* The Plant Industrial Engineering program, including establishment of proper production standards and work schedules to obtain economical production consistent with proper plant operations.
   - *h.* The Plant Industrial Relations program, including labor relations, safety, medical program, recreation, employee benefits, and employee development program.
   - *i.* The plant protection activities, including police and fire protection.
   - *j.* Operation of the plant cafeterias.
   - *k.* The preparation or review of reports covering major plant activities.
2. Plans and schedules production of yarn, pursuant to spinning programs established by the Director of Processes and the Sales Departments.
3. Surveys and approves general plans for major extensions to plant buildings and equipment, to increase production.
4. Directs the design and construction of such improvements and additions to plant buildings and equipment as fall under the authority of the Plant Manager.
5. Proposes improvements and additions to plant buildings and equipment that are not under the authority of the Plant Manager.
6. Authorizes expenditures up to $2,000 with respect to buildings or plant equipment.
7. Recommends sale or acquisition of property as conditions warrant.
8. Participates with the Director of Engineering in the planning of office layouts and the allocation of space for the plant offices.
9. Authorizes installation of telephones in plant and corporate offices at Enka; and determines type of service to be provided in each instance.
10. Approves outside contractors to enter and work in plant; and checks to see that they abide by company rules and regulations while in the plant.
11. Authorizes all personal belongings and contractors' equipment to be carried out of the plant with "gate pass."

12. Approves all appropriation requests for the plant.
13. Approves all purchase requisitions initiated by plant departments before submission to the Purchasing Department.
14. Assumes responsibility for the establishment of a price list and the pricing of scrap, obsolete, and stock items which may be sold to employees; authorizes the sale of these items to employees.
15. Makes arrangements for assisting the other plant in cases of breakdowns, emergencies, etc.; and sends materials and personnel when needed.
16. Assumes responsibility for maintenance and operation of flood controls for protection of plant and property in case of high water.
17. Notifies union officials on all changes in operation, as required by agreement between the union and the Company.
18. Determines necessity of and authorizes all overtime of plant employees.
19. Authorizes removals, change of rates, transfers, or any change in job status of plant employees.
20. Makes recommendations to the Technical Vice President concerning plant personnel attending professional conferences or meetings involving travel.
21. Authorizes leave of absence for plant personnel for periods exceeding one week.
22. Presents service awards to employees attaining 25 years of service with the Company.
23. Authorizes travel of plant personnel for normal Company business, based on the request of the department heads.
24. Approves petty cash, travel, and expense vouchers for reimbursement of $100 or more for plant personnel, and all Lowland mileage vouchers.
25. Authorizes transportation as requested when needed, and the purchase of transportation equipment (cars, buses, trucks, fire trucks, etc.).
26. Authorizes the taking of pictures inside the plant enclosure and approves same for publication.
27. Assumes responsibility for contact with the press in the release of news regarding plant activities.
28. Authorizes the issuance of plant regulations necessary to carry out the above responsibilities.
29. Assumes responsibility for the handling of plant entertainment and entertainment for the corporate offices as directed.

Relationships

1. The Plant Manager is directly responsible to the Technical Vice President.
2. The Chief Chemist, superintendents of the Rayon and Nylon Department, and heads of auxiliary departments are responsible to the Plant Manager.
3. The Plant Manager will maintain close liaison with the heads of all staff departments in carrying out the Company programs and policies.
4. He will also maintain close relationship with outside organizations, suppliers, and contractors with whom the plant is doing business.

29 Samson Chemical Company: Group Leader

by Conrad Berenson

Job Title: Group Leader—Chemical Research
Job code: A-456 *Dept.:* Thermosetting Plastics
Date: Nov. 13, 1962 *Location:* N.Y. Laboratory
Description prepared by: T. Smith

Job Summary

Provides first-line technical and administrative supervision for chemists and chemical engineers engaged in innovating and developing applications for thermosetting polymers.

Job Duties

1. Assigns areas of investigation to chemists and to chemical engineers.
2. Selects important variables to be studied in the different research problems (occupies 10% of the Group Leader's time).
3. Consults with the workers in his group to provide technical guidance (occupies 20% of the Group Leader's time).
4. Reads technical journals in the field of thermosetting polymers (approximately 12 monthly) to remain in the forefront of the state of the science (occupies about 10% of the Group Leader's time).
5. Attends frequent scientific meetings on thermosetting polymers at universities, industry seminars and trade shows (takes 10% of Group Leader's time).
6. Provides technical consultation to customers with severe thermosetting resin applications problems (occupies 10% of Group Leader's time).
7. Writes weekly and monthly reports to the Director of Plastics Research regarding research and development progress (takes 20% of Group Leader's time).

Performs routine administrative duties, i.e., signs time sheets for his group, keeps attendance records, rates his workers, purchases supplies for his group (occupies 20% of Group Leader's time).

Job Specifications

Education: Ph.D. in Polymer Chemistry; courses should have included macromolecular theory, differential and integral calculus, differential and partial differential equations (mathematics beyond Fourier analysis is not required), 3 years of physics, 3 years of organic chemistry, 3 years of physical chemistry. Should be conversant with computer applications and mathematical statistics.

Experience: 10 years of total relevant work experience beyond the Master's degree date; 5 years of education (student or teacher) may be included in the above. Experience should be in high polymer theory and applications.

Physical Demands: Good health to meet the demands of frequent travel to and contact with personnel outside the company at seminars, conventions, consulting assignments, etc. Must have vigor and stamina to perform the manifold job duties.

Supervision: will supervise 6-10 chemists and chemical engineers; reports to Director of Plastics Research. Must be able to communicate orally and in writing—both vertically and horizontally in the company organization.

Working Conditions: Good. 80% sitting at a desk in a comfortable, quiet, air-conditioned office.

Responsibilities: to be able to keep the company in its outstanding position in thermosetting polymers research through his skill in leadership and research.

Source: Samson Chemical Company.

The managerial aspirant is generally very much concerned with the realization that he may never be given an opportunity to develop and display his intrinsic value as a manager. Fortunately, during the past decade many forward-looking enterprises have come to understand that the development of the individual is as much a managerial task as expediting the firm's production or supervising its product policy. To this end, these firms have established definite programs for the selection and development of managerial personnel.

The American Enka Company's program is presented below. It is important to note that this excellent program includes a number of practices which are considered by management training specialists to be vital in any effort to maximize a firm's human resources. Enka's plan recognizes, for instance, that it is only by providing the individual with challenging experiences that he can develop himself properly; there is no test and no teacher like meaningful and risky business decisions. Further, the program also recognizes that the true measure of managerial worth is performance on the job—Enka makes this a primary factor in selecting managerial candidates.

30 American Enka Corporation

by Lester F. Zerfoss

The American Enka Corporation is one of the large rayon producers of the United States, with plants located at Enka, North Carolina, and Lowland, Tennessee. In addition to two rayon yarn plants, the company maintains executive and administrative offices at Enka and executive and sales offices in New York City. District sales offices are located at Providence, Rhode Island; Greensboro, North Carolina; and Chattanooga, Tennessee. In 1954 the company began production of nylon staple

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Reprinted with permission from: M. Joseph Dooher and Elizabeth Marting (eds.), *Selection of Management Personnel*, Vol. 2, (New York: American Management Association, 1957), pp. 239–255. *Mr. Zerfoss is Staff Advisor for Executive Development at American Enka.*

fiber in a new plant at Enka, and since then nylon industrial-type and textile-type yarns have been developed and marketed. The company now employs about 5,100 people.

The research facilities of American Enka have recently been augmented by the construction of a new research center at Enka, devoted primarily to the development and improvement of both textile and industrial fibers. Also, a rayon staple fiber plant has been under construction at the Lowland site. Production in this new plant began in December, 1956.

Reporting to the president in American Enka's organization are four operating divisions, together with administrative and staff services located in the office of the president. Heading the four operating divisions are the vice president for manufacturing, vice president for research and development, financial vice president and general counsel, and general sales manager. Included in the office of the president are the executive assistant to the president, director of general industrial relations, manager of management services, and staff advisor for executive development.

Background and Objectives of Approach to Management Selection

The background and objectives of the company's selection program can best be stated in the words of its president, John E. Bassill, who reemphasized them in a talk to company supervisors in 1955:

> The skills of managing can be learned. But we must start with the firm knowledge that the increasingly complex job of managing requires training and special skills which, however, can be acquired. It is increasingly coming to be recognized as a distinct and professional type of work. And, like the job of an engineer or chemist, the job of managing demands years of practice and study before a man can consider himself adequate to meet the basic needs of the job. And even then the real manager never stops learning—he is a lifetime student of management.
>
> No one can just read a book and become a manager, nor can he become a manager overnight merely by receiving a new title or new responsibilities. I speak from 35 years of observing managers, and, believe me, managerial skills cannot be picked up in 10 easy lessons. But they *can be learned,* and they *can be profitably applied.*
>
> So it is only by recognizing the basic principle that managing can and must be learned that we can meet our manager development objective.
>
> Enka's manager development objective is, first of all, to aid each manager to become a better manager and, secondly, to select, administer, and utilize our human resources so that there will always be an adequate supply of well-qualified people ready to meet the company's needs for managers.

Now, to attain this objective there are five things that the company must do and that you, as a manager, must do for the people under your jurisdiction.

First, we must select only the best available people for advancement. This applies not only to promotion from within but also to selection from outside when necessary. Do not let the term "best" mislead you. It is not limited to technical competence; it is not limited to managerial skills; it is not limited to the ability to work with other people—it includes *all* those things, plus many others.

Second, we must provide the managers of the company, along with all those who aspire to become managers, challenging experiences for self-development on their present jobs; and we must give them maximum opportunities to demonstrate—through top-notch performance—both their willingness and their ability to grow, *thus earning the right to be considered for advancement.*

How can we provide these challenging experiences? The most obvious way, in this case, is the best way—by delegating responsibility and authority to subordinates. By this I mean delegation in its true and complete sense. This is a highly important subject, which I can only mention at this time but which I hope you are considering carefully.

Another way, and an effective one, is by making special assignments which require for their successful completion a high degree of initiative, imagination, and judgment.

How can we determine which employees have earned the right to be considered for advancement? This question is perhaps the key to manager development. Regardless of how much opportunity and experience is provided employees, regardless of how well we meet the other elements of the manager development objective, the effort will fail unless we follow effective methods, such as the Personnel Development Program, for discovering the employees who deserve consideration for advancement.

The *third* thing we must do to meet the manager development objective is to stimulate all those in management positions to set progressively higher standards of leadership and competence for themselves and their subordinates, in order to insure a dynamic and flexible managerial team which is able to meet the needs of the management job that lies ahead of us.

There are a number of things we can do to raise the standards in our company, but almost all of them must start with the manager. If a capable manager sets high standards for himself—and meets those standards—then his people will be led to elevate their standards voluntarily. This may explain why research in group behavior has found that superior performance and high morale can exist in departments which have few employees with outstanding ability.

The *fourth* thing we must do to meet the manager development objective is to encourage sound thinking and efficient work habits so that managers will have both the desire and the time to carry out more effectively and naturally their responsibilities for the development of their subordinates.

The *fifth* thing we must do to meet the manager development objective is to assist each manager to work with his people in such a way that their group activities will provide them basic experience in teamwork and cooperative effort.

> We know that the best managers are those who have learned to work with other people . . . who have learned that a good leader must also be a good follower . . . and who have learned that they must work with their people as a *group* as well as individuals.
>
> One of the most important skills of a successful manager is the ability to stimulate teamwork through the development of understanding and a strong sense of participation among his people.

Personnel Development Program—Basis for a Reservoir of Management Potential

The Personnel Development Program referred to by Mr. Bassill provides a developmental basis on which the company's selection of executives and supervisors rests. This program, which has been in effect throughout the company since January, 1953, is designed to aid the management of the company accomplish the following objectives:

1. Obtain maximum utilization of its human resources.
2. Provide the maximum degree of opportunity for employees to improve their job performance. This recognizes that top-notch performance on the present job is the greatest single factor influencing selection for advancement.
3. Insure that employees who have earned the right to be considered for advancement, through outstanding performance on their present jobs, will be included in the list of candidates from which selection will be made in filling vacancies for which they are qualified.
4. Have available trained people for replacements, as vacancies occur.

The Personnel Development Program is centered in the individual as a member of his work group. It provides a basis for the continuing growth of each person toward the highest management responsibility he is capable of assuming. It implements in a real down-to-earth way the long-range objective of an organization to promote from the ranks—to find inside its own structure the human resources needed to meet *on time* the normal adjustments and replacements of personnel. It is based on the conviction that a company's greatest untapped resource is the underdeveloped potential of its manpower, whether in the plant or the office.

The program is not an additional duty for the manager. Actually, it is a more efficient and orderly way of carrying out his major and continuing responsibility—that of providing opportunities for his people to develop. It provides a periodic inventory of the performance of all salaried people at all levels in the organization. Its purpose is to help them to do a better job in their present positions and to develop their full potential. In this way the organization will have qualified people ready to fit into vacancies as they occur.

Some important features of the approach are:

1. The appraisal of job performance is informal and natural. It is made jointly by the several people best informed and most concerned about the progress of the employee being appraised.
2. It brings into focus the two most important forces in the employee's development: (*a*) a recognition of and concern for his own growth needs and (*b*) the mutual understanding between himself and his own immediate supervisor as an active partner in helping him reach agreed-upon development goals.
3. Forms and procedures are uncomplicated and tentative; they can be modified and improved with experience.
4. Major emphasis is placed on positive steps for the self-development of the individual.
5. The plan is highly flexible. It can adjust to varying standards at different levels. It can be adapted to different operating conditions.
6. It provides a continuing inventory of management resources.

The steps involved in the Personnel Development Program may be summarized as follows:

Appraisal. A review of the performance of each salaried employee is made jointly by three or more people at appropriate levels who are in the best position to evaluate his performance and potential. Appraisal centers on the performance, personal qualifications, and current status of the person being appraised. It also considers the steps that should be taken to help him develop. Only those results on which there is unanimous agreement are recorded.

Review. Appraisals of salaried people within an organizational unit are presented by the head of that unit to his immediate superior. At this time the entire appraisal is reviewed, and development plans are discussed, perhaps amended, and approved.

Discussion. The immediate supervisor discusses the appraisal of the individual with him. The tone of this interview, or series of interviews, is one of frankness. It should be helpful and encouraging, not critical. Specific possible avenues for improvement are jointly explored.

Development. Continuing development of the employee takes place in two ways: (1) immediate action on training plans agreed upon in the discussion interview that can be put into effect at once and (2) a definite long-range training plan and timetable worked out by the supervisor and employee in terms of management's needs, the recognized potential of the employee, and his own desire to improve.

Inventory. Once each year, after all appraisals have been completed, a report of appraisal results and development activities is forwarded up the line to division heads. The president and his staff review them in order to evaluate the effectiveness of the program and make the necessary decisions to provide continuing guidance and direction.

The first round of the Personnel Development Program, consisting of appraisal, review, discussion, development, and inventory, was completed on July 1, 1954. During this first round, attention was necessarily focused on the appraisal phase of the program. In the second round of appraisals, during 1955, additional responsibility was given to department heads to work out appropriate schedules and departmental plans for the most effective utilization of their appraisal time. In working out these plans and schedules, emphasis was placed on appraising (1) supervisors, (2) personnel not previously appraised, and (3) people who were in special need of appraisal because of contemplated administrative changes such as promotion, transfer, special assignments, or increased responsibility. Emphasis was also placed on the immediate supervisor to work out with the appraisee constructive development plans through guidance, training, and appropriate work experiences to help the appraisee improve his performance and prepare himself to take greater responsibility.

As an outgrowth of the company's experience with appraisals in 1955, it became apparent that a major improvement in the program could result from a shifting of appraisal scheduling and planning as it had been done in the past to a scheduling plan based more specifically on an individual's work experience. In order to accomplish this and at the same time spread the work of appraising across the entire year, each person eligible for appraisal is now appraised at the time of the anniversary date of his employment. In order to provide administrative flexibility in carrying out such a continuing program of appraisals, it has been suggested to each department that a specific plan should be set up to insure that appraisals will be scheduled within one month following the employment anniversary date *or,* if it is preferable, the anniversary date of a person's most recent promotion.

Each supervisor has the continuing responsibility for the development of all his employees to insure that each one is getting the experience and training he ought to have to improve his job performance.

Therefore, each supervisor is encouraged to re-examine, at the time of the employee's anniversary, the prior appraisals of each and evaluate the effectiveness of the training that has gone on to date. Occasional discussions are held with the appraisee to develop a better understanding of the methods being used to meet the needs established by appraisals. Supervisors then discuss their development plans with their superiors so that development action is in line with the needs of the organization. These development activities may be a continuation of the training recommended by the appraisal group, or they may be directed at meeting other areas of need brought out in prior appraisals.

Developmental Goals for Company's Managerial Personnel

The characteristics which American Enka seeks in its candidates for managerial positions can best be expressed in the company's policy statement of its developmental goals. These goals may be more easily understood if we separate them into two major areas: what a man *is* and what he *is becoming.*

The *first area* is that of character and integrity. This area is concerned with the basic nature of the man himself—the kind of man it takes to become a manager. Character is not something that a man picks up through education or training. It is not a fund of knowledge, a set of skills or habits which he can acquire. In looking for managers, only the man of character can be considered, for only when a man has this basic quality can he hope to qualify and equip himself as a leader of others.

While character may be hard to define, there is rarely any doubt about its effect on other people. When it is present, it generates loyalty, faith, and confidence in others. It may be perceived and appraised by associates as sincerity, trustworthiness, dependability, or honesty. More informally, a man of character is spoken of as one who can be counted on, a square shooter, a man whose word is as good as his bond.

Any man who would realize his own greatest potential as a manager must think through for himself this matter of personal character and integrity. Such an inward look will force him to answer for himself four fundamental questions. As a manager, am I—

1. Conscious that my character should serve as a model for my subordinates?
2. Willing to earn the loyalty, respect, and confidence of my people through the things I do as well as through the things I say?

3. Willing to guide my subordinates by emphasizing their strengths and by helping them correct their weaknesses?
4. Willing to make my decisions on *what* is right rather than *who* is right?

The *second area* for consideration in understanding the developmental goals for our managerial personnel deals with those attitudes, understanding, knowledge, skills, and personal habits which can be developed by the potential manager through self-analysis, education, study, insight, practice, and receptiveness to counsel and guidance.

The following outline, through a series of introspective questions, spells out the developmental areas which are most important to the individual in his life-long efforts to become a professional manager. It is realized that no potential manager or manager in his current stage of growth has all these qualities and skills to a maximum degree. To look carefully at himself in terms of these abilities, qualities, and skills is a sight-setting experience which can be of great value to the individual in planning and working toward his continuing growth. The questions suggested not only can be a guide to self-appraisal and self-development but can do much to set the standards for the company as a whole in its effort to *find, select,* and *promote* the men who have earned the right to consideration.

In becoming a top-notch employee, to what degree

1. Am I growing in emotional maturity and stability?
2. Am I self-understanding?
3. Am I sensitive to the feelings of others?
4. Do I show work interest? Drive? Staying power?
5. Does my work show initiative, resourcefulness, inventiveness, originality, innovation, imagination?
6. Do I seek to improve my technical competence?
7. Do I set high standards of work performance for myself?
8. Do I take active measures to profit by my mistakes?

In striving to become a good leader, to what degree do I

1. Set the example of an outstanding job performance on my present job?
2. Inspire confidence, loyalty, and acceptance in others?
3. Teach, coach, and guide the development of my people?
4. Organize, build, and maintain an effective group activity?

5. Become a rallying point in times of stress and crisis?
6. Motivate and stimulate men to do their best?

In learning to become a good manager, to what extent can I be counted on to

1. Set and reach objectives and goals through other people?
2. Plan and organize my work and that of my group?
3. Integrate the activities, personalities, and resources of my group into a dynamic, unified, productive team which is an effective unit of the enterprise as a whole?
4. Measure and evaluate results?
5. Guide the development of my people?

In applying the knowledge and skills of management in the American Enka Corporation, to what extent do I

1. Understand and identify myself with the goals and objectives of the company and its philosophy of management?
2. Have a growing understanding of the business of the company in relation to the industry and the economy as a whole?
3. Have a broad working knowledge of the company's policies, systems, management tools, and programs?
4. Have the habit of striving for continuing growth, reaching for and utilizing available company resources for self-development in the attitudes, knowledge, and skills of the professional manager?

Effective Utilization of Qualified Candidates

As previously indicated, the Personnel Development Program is the basis of a periodic appraisal of the performance of all salaried personnel at all levels in the organization. The purpose of such appraisal is to help every individual employee do a better job in his present position and to help him further develop to his full potential. By means of day-to-day development of people through challenging work opportunities, guided and interpreted work experience, and the utilization of company training resources to meet individual needs, the company is building and maintaining a reservoir of people who are doing outstanding work on their present jobs and thus are earning the right to be considered as candidates to fill promotional vacancies.

The responsibility for the selection of people to fill supervisory and executive positions in the company is the responsibility of line management. At the time when a vacancy is to be filled, candidates whose work performance has qualified them for consideration are usually reviewed in the following order:

1. The people who merit promotion in the reporting group of the executive to be replaced.
2. Qualified people who could be promoted or transferred to the job from other areas inside the company.
3. Candidates outside the company, if a careful search for promotable people in either of these internal areas fails to locate a qualified individual.

Staff services located in the office of the president, covering the areas of manager development and employee relations, are available to assist the line organization in the review and selection of potential candidates.

Line managers are using a variety of tools and techniques to improve their skills in selecting managerial candidates. Perhaps the most basic tool, as mentioned before, is the annual appraisal of job performance. Significant improvements in the appraisal technique have been obtained through the use of job descriptions, statements of responsibility and authority, performance standards, and special departmental reports on performance. Increasingly, managers are utilizing, with assistance from appropriate staff sources, background and developmental information to insure an adequate informational basis on which to make comparisons among qualified candidates for a given position.

Top management has insistently raised the standard of selection, not merely to find a qualified candidate for a job but to review the data on qualified candidates *in depth* to be sure that the best-qualified candidate will be selected. To this end, the company in some areas is beginning to try out, in filling key executive vacancies, an individual development profile which brings to the manager making the decision, not only a candidate's personal education and experience record and job performance record, but also psychological information which might have a bearing on his growth potential in the job for which he is being considered. The objective of the profile is to bring together in one place a comprehensive picture of the candidate so that line managers can exercise their best judgment against all the facts available for intelligent selection and placement.

The accompanying individual development profile, filled out for John Doe on a hypothetical basis, will exemplify the nature and scope of the information available to line executives at the point of choice and decision making in the selection and placement of key supervisory and executive personnel. The information included is built up from various sources: The statistical, personal, educational, and health information is taken from current personnel records. The second block of information, dealing with work performance, is drawn from the line supervisor's appraisal summaries and development notes growing out of his activities in the Personnel Development Program. The third block of information, dealing with the candidate's personality aspects, is obtained from a psychological assessment or evaluation of potential available through the company's psychological services.

The "Summary of Promotability" provides an analytical condensation of all this information in order to make it easy to compare this profile with profiles of other qualified candidates.

It is intended that the individual's profile be brought up to date and made available to the line manager who has the responsibility for selection at those times when he is actively considering the candidate for a particular job vacancy.

While the program has been in operation too short a time to identify results specifically, the following points of importance seem indicated:

1. Increasingly, there is greater awareness at top management levels of the individual people available for promotion within the company.
2. As candidates are reviewed in the process of selection, the strengths of individuals who are considered for, but do not receive a particular appointment, stand out; and the developmental steps necessary to qualify them for future consideration become clearer. The climate of confidence increases and supports the development of outstanding people.
3. The reservoir of outstanding people has developed from a rather ill-defined pool to lists of specific individuals with much more sharply highlighted qualities and experience.
4. There has been an increased concern and sense of responsibility for promotion from within.
5. Since selection techniques have been completely line-centered, designed to increase the responsibility of the supervisor in choosing his subordinates, there has been a net increase in the confidence of the line supervisor in his own judgment and therefore an increase in his general ability to supervise and guide the subsequent development of the people whom he has selected.

INDIVIDUAL DEVELOPMENT PROFILE

Name: Doe, John Job Title: Industrial Standards Engineer

DATE OF BIRTH: 3-26-26 DATE EMPLOYED: 4-15-52

MARITAL STATUS Married, 2 children Supervisor: Manager, Industrial Engineering Unit

EDUCATION: B.S., Industrial Engineering Department: Industrial Engineering
City College, June 1951

ACTIVITY PROFILE	DATE	COMMENTS June 10, 1956
Age This Year	1956	30
Years to Retirement	1956	35
Status Changes	Note 1	Employed as Time Study Clerk
Salary Changes		Present salary: $147 per week
Outside Educational Courses	Note 2	Some graduate work at City College
In-Company Courses		Took part in Ind. Eng. study course, 1952
Professional Activities		Member of local Engineers Club
Personal & Community Activities		Member of Army Reserve
Significant Work Experience	Note 3	Job rotation, preparation of handbook
Performance Results	Note 4	Quality and quantity of work excellent
Working Methods	Note 5	Work well thought out; clearly presented
Personal Qualifications	Note 6	Keenly analytical, cooperative, industrious
Strongest Qualification		Technical ability
Need for Improvement		Supervisory experience
Recommended Action	Note 7	Broaden experience
Developmental Progress	Note 8	Temporary assignment in No. 2 Plant
Current Status (Individual)		1954: Promotable; 1955: Immediately
Current Status (Group)		promotable
Intellectuality	Note 9	Superior intelligence
Emotional Maturity	Note 10	Has made gains in emotional maturity
Relations with Others	Note 11	Works well with other people
Self-Understanding	Note 12	Sensitive to criticism
Organizing Ability	Note 13	Shows promise as a supervisor
Health History	Note 14	Health is excellent
Counseling Problems	Note 15	Eager to learn managerial skills
Summary of Promotability	Note 16	Promotable with continued training
Integrity—Character	"	
Outstanding Job Performance	"	
Potential for Growth	"	
Managerial Skill	"	
Creativity	"	

Footnote No.	SIGNIFICANT INFORMATION
Note 1	Employed as Time Study Clerk, $64 per week. Temporarily transferred for training to No. 3 Plant; promoted to Methods Engineer, $78 per week, 6-20-53, promoted to Administrative Assistant to Manager, Industrial Engineering following 1954 Appraisal, $93 per week, transferred to No. 2 Plant and promoted to present position, 2-1-56, $135 per week.
Note 2	Took some graduate courses at City College while in previous employ—standards, cost analyses.
Note 3	Six months' training in No. 3 Plant, Industrial Engineering Unit. Three months' orientation period through production units. Helped prepare handbook for use by industrial engineers taking in-company course in 1952. Led two of the sessions on standards. In 1954, conducted special research on workload analysis.
Note 4	1954 Appraisal: Quality and quantity of work satisfactory. Overall results are very good. Quality of results in workload analysis assignments quite helpful in long-range planning. Report well prepared. 1955 Appraisal: Quality and quantity of work continues to be excellent. Plans and organizes his work well and arrives at sound conclusions.
Note 5	1954 Appraisal: Follows in proper channels in carrying out assignments; tactful. Sometimes becomes absorbed in work and tends to be under slight tension. Meets his deadlines and works effectively. Reports well written, showing clarity of thought and presentation. Gets along well with people with whom he contacts regarding an assignment. 1955 Appraisal: Written reports well prepared. Meets deadlines well. Has improved in reducing tenseness while under pressure. Approach to people excellent in obtaining necessary information to carry out assignments.
Note 6	Both appraisals point up excellent technical ability and keen analytical mind. Also notes tactful and cooperative manner in dealing with people. Is very industrious and seems to receive quite a bit of job satisfaction.
Note 7	Has been an "individual contributor" so far and should be given assignments to provide supervisory and managerial experience. Every reason to believe he can learn managerial skills as appraisals show he works well with people at all levels. On-the-job training in managerial skills recommended.
Note 8	Given temporary assignment in No. 2 Plant to provide supervisory experience. Will supervise industrial standards groups. Will promote to permanent supervisory position if successful in this temporary assignment. Note made on development summary by immediate supervisor: "Will give him opportunity to learn to manage with a small number of subordinates. Also will suggest he may get help from attending supervisory meetings on managerial skills now being given for potential managers by the supervisory development section. Will use delegation skill to help him (and me) in man-boss relationship."
Note 9	1956 Psychological Evaluation: He ranks in the superior group in general intellectual competence. He is a quick thinker and is ready to meet difficult

challenges. He is broad, analytical, creative, and imaginative. He thinks in terms of basic principles and values. He is flexible in his reactions to the intangible human factors in situations.

Note 10 1956 Psychological Evaluation: He has gained considerable emotional maturity in recent years. He is becoming increasingly independent, is gaining poise, and is learning to cope with pressures and tensions. He possesses plenty of drive and healthy ambition. His values in life are sound and well thought out. He is a person of character and integrity.

Note 11 1956 Psychological Evaluation: He is direct and sincere in his personal relations. He gains genuine pleasure from helping others. He is an assertive person and will not back down from a position which he feels is right. He has a hearty, jovial manner and strives to be accepted as a "regular fellow."

Note 12 1956 Psychological Evaluation: He is strongly motivated toward self-improvement, especially in wanting to acquire the knowledge and skills needed to succeed in his field. He works hard to overcome shortcomings when they are pointed out to him. He is quite sensitive to criticism but will profit from any criticism which he feels is fair and objective.

Note 13 1956 Psychological Evaluation: He has superior ability to plan and organize tasks or procedures where he performs most of the work. As yet, he is essentially an individual operator who has not fully learned the essence of team play when attempting to deal with problems which involve others. In general, however, he is more and more learning to work *with* rather than *over* people. Potentially he seems to have the qualities needed for a good supervisor. He sees the broad picture and is capable of long-range planning and development. He is also able to infuse others with enthusiasm and drive.

Note 14 Available medical reports show him to be a normal, healthy person with no serious defects. His attendance record has been excellent. Participates in company's volunteer annual medical check-up.

Note 15 Observation of staff counselor: During the past year as he has had occasion to supervise a small technical group, he has been anxious to learn the skills of supervision insofar as this group would give him the opportunity to try out some of these skills. He has attempted to use his staff meetings to improve teamwork and build morale in his work group. His assignments have been carefully thought out and given with a view to increasing the experience and competence of the people to whom he has given them. He has asked for and received considerable help in conducting the developmental appraisals of his subordinates.

Note 16 Summary of data: John Doe has demonstrated that he is a man of character and integrity. His technical work as an industrial engineer has been outstanding. Psychologically he shows considerable growth potential. He is creative, imaginative, and resourceful when working on difficult assignments. He shows promise as a future manager providing he is able to make the transition from the technician to the supervisor of technicians, learning the skills necessary to get his results through others. At the present time, as supervisor of a small technical work group, he is showing considerable promise in gaining these skills. When he has matured in this area, he will be ready for promotion to the position of Section Head.

The foreman is a vital link between management and the worker; he must represent management to the worker and the worker to management. In such a sensitive position, he has come to be called "the man in the middle." All too often, however, the importance of his middleman's role has been neglected, and as a consequence relatively few firms take a systematic approach to selecting and training foremen.

Monsanto Chemical's Plastics Division is a noteworthy exception. The following article presents Monsanto's program of foreman selection; it is relatively unique in that it provides for self-nomination by the worker. Also, the program is objective and systematic. As such, it can go a long way towards establishing industrial peace, since the worker knows that he can be considered for advancement.

31 Monsanto Chemical Company: Plastics Division

from Selection of Management Personnel

Since the firm was founded in 1901, the Monsanto Chemical Company has grown to an organization of 15,000 employees in 20 plants across the country. Monsanto is a process industry in the field of plastics and chemicals, with headquarters at St. Louis, Missouri. The program of foreman selection here described is in use at the Plastics Division in Springfield, Massachusetts, where there are 2,600 employees, including 411 first-line supervisors.

Highlights of the program

It is significant to note that the foreman selection program was developed as a result of discussion by all production supervision in management roundtable sessions.

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As a first step, any wage employee may request consideration by notifying his foreman. Arrangements are then made by the foreman for the employee to be tested. The second step is an interview by a general superintendent *from an area in which the candidate has not worked.* Following this interview, a departmental evaluation is obtained from the candidate's immediate supervisor. Using these data, plus the results of a medical examination, the plant manager and the general superintendents advance the best-qualified individuals into the foreman selection pool from which future selection will be made.

Reactions to this program have been extremely favorable. Wage-roll employees are convinced that selection is now made on the most objective basis possible, and that favoritism is minimized or eliminated. In addition, management is now in a sounder position with respect to the union. A given selection can be more completely supported. And finally, owing to participation in planning the program, supervision has taken a special interest in the development of the individuals selected under the plan.

Background information

Prior to 1951 our method of selecting first-line supervision from the hourly ranks followed the common industry pattern. The procedure was mainly based on opinions and recommendations of the supervisory group. However, Plastics Division production supervision has never underestimated the importance of its first line. When we consider the number of people who are affected either directly or indirectly by this first line, and when we realize that in the last analysis our ability to get things done through people makes the big difference in the cost sheets, it becomes obvious that every effort should be made to select topflight material. In the spring of 1951, all production supervision was appraised of this foreman selection problem and asked to come up with an improved selection plan through the medium of the supervisory conference program. The following policy and procedure are the result of the thinking and experience of these 250 people.

Policy

First consideration will be given to current employees when selecting foremen.

A systematic, fair, and accurate method will be applied in the selection process.

Every effort will be made to evaluate candidates in an objective and comprehensive manner. Prime consideration will be given to the following factors in selecting new foremen.[1]

1. Health.
2. Intelligence.
3. Job knowledge.
4. Safety-consciousness.
5. Initiative.
6. Leadership.
7. Integrity.
8. Reliability.
9. Loyalty.
10. Ability to get along with people.

Article X, Section 5, of the union contract provides:

> The Company agrees that before promoting employees from the bargaining unit to a supervisory position it will consult with the Negotiating Committee and give due consideration to its opinion. In the event of disagreement, the final selection shall rest with the Company.
>
> The Company will provide the new foreman with such training as is necessary to assure his continued development as a member of the management group.

Procedure

The present procedure differs somewhat from that originally employed. As we gained experience with the program, we found ways of streamlining its operation. The procedure as outlined below is essentially the same as that suggested in the supervisory conferences. The main difference is that currently any hourly employee may volunteer to be considered as a candidate for a supervisory position. Originally it was necessary that a man be recommended by his supervisor before he could enter the selection process. The current procedure is as follows:

1. Any wage employee may indicate interest in being considered for a supervisory position by notifying his foreman. The foreman then makes the necessary arrangements for each candidate to be given an opportunity for consideration.

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[1] Two of these factors, health and intelligence, can be measured objectively. The remaining eight are judged by the supervision of the man involved with the help of the departmental evaluation and the interview with the candidate.

2. As a first step, each candidate is administered tests which take approximately one hour. These are the modified Alpha Examination, Form 9, an intelligence test, and the Test of Mechanical Comprehension, Form AA.[2] The latter measures the ability to perceive and understand relationships of physical forces and mechanical elements in practical situations. The person who scores high on this trait tends to learn readily the principles of operation and repair of complex devices. Formal training in physics does not appear to increase the score significantly. Also, this test has relatively low correlation with intelligence tests.
3. The candidate then receives an interview of one to two hours' duration. This interview is administered by a general superintendent from an area in which the candidate has not worked. The reasons behind this condition are twofold:
    - *a.* A general superintendent is more readily available to the other general superintendents to substantiate or to clarify written comments concerning portions of the interview before a candidate is placed in the foreman pool.
    - *b.* By having this interview handled by a general superintendent outside the candidate's work area, an evaluation from an additional party is added (Exhibit 1).
4. Following the interview, a departmental evaluation is obtained from the candidate's immediate supervisor by a member of the Personnel Department. This evaluation is for purposes of obtaining additional information relative to a candidate's (1) leadership qualities, (2) relations with others, (3) attitudes, and (4) job knowledge (Exhibit 2).

Exhibit 1

MONSANTO CHEMICAL COMPANY

INTERVIEW RATING FORM

Name Date Age Interviewed by

I. WORK HISTORY

	Below Average	*Average*	*Above Average*
1. Duties			
2. Previous technical experience			
3. Number of previous jobs			

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[2] Both tests are copyrighted and distributed by The Psychological Corporation, New York City.

Exhibit 1 (Continued)

	Below Average	Average	Above Average
4. Work involved in contact with people?			
5. Likes and dislikes			
6. How closely supervised?			
7. Working conditions			
Hard work, long hours?			
Reaction to detail?			
8. Level of earnings			
9. Any leadership experiences?			
10. Reasons for changing jobs			
11. Reasons for seeking a job here			
12. Factors of job satisfaction			

EDUCATION AND TRAINING

	Below Average	Average	Above Average
1. Take advantage of educational opportunities?			
2. Best and poorest subjects?			
3. Honors and activities			
Level of school grades			
4. Reasons for leaving school			
5. Special training since leaving school?			
6. How was education financed?			

PERSONAL HISTORY

A. Early Home Background

	Below Average	Average	Above Average
1. Father's occupation, interests and temperament?			
2. Socio-economic level			
3. Childhood factors:			
Brothers and sisters?			
Overprotective parents?			
Upbringing lax or strict?			
Parental guidance?			
4. Earliest age *partially* or wholly financially independent			

Exhibit 1 (Continued)

B. Present Home Adjustment

	Below Average	*Average*	*Above Average*
1. *Present interests and hobbies*			
2. Marital status			
3. Present living arrangements			
4. Wife's (husband's) attitude toward this job			
5. Dependents (number and age)			
6. Financial stability *Housing, life insurance*			
7. Transportation to work?			

C. *Manner and Appearance*

	Below Average	*Average*	*Above Average*
1. Neat, clean-cut appearance?			
2. Any unfavorable mannerisms? *Affected speech?*			
3. Health status Unfavorable health history? Physical vigor and stamina?			

D. Personality Qualifications

	Below Average	*Average*	*Above Average*

+ equals "definitely" — equals "lacking" √ equals "adequate"

( ) 1. Emotionally mature
( ) 2. Teamworker
( ) 3. Responsible
( ) 4. Conscientious
( ) 5. Tactful
6. Honest and sincere
7. Even-tempered
8. Hard worker
9. Self-discipline
10. Initiative
( ) 11. Perseverance
( ) 12. Adaptable
( ) 13. Aggressiveness
( ) 14. Self-confidence

IV. SUMMARY AND RECOMMENDATIONS

V. OVER-ALL RATING

Excellent *Above Average* *Average* *Below Average*

Exhibit 2

DEPARTMENT EVALUATION FORM
FOREMAN SELECTION PLAN

Candidate's Name____________________________________

Dept.____

Date________________ Rated by_

How long have you been in a position to observe this man's work?_

Over-all Rating_

Poor Risk *Adequate* *Outstanding*

1. LEADERSHIP—*Think in terms of this person's ability to get individuals and groups to do something.*

Questions:

A. Has he had occasion to try to get individuals to do something?
On the job?
On union activities?
Outside?

B. Has he ever acted as replacement foreman or lead operator? If so, describe the occasion.

C. How did he make out on those occasions when he acted in a leadership capacity?

2. RELATIONS WITH OTHERS—*Consider ability to get results when dealing with other individuals or departments.*

Questions:

A. An employee has to get along with his fellow employees and his supervisors. Would you say he gets along better with his fellow employees or his supervisors?

B. Could you give me some specific examples of good relations?
Poor relations?

3. ATTITUDE—*Consider this man's general approach toward his fellow workers, his job, the company.*

Questions:

A. You have some men you can depend on to do a job—to get it done when you want it. Is this fellow one of them?

Exhibit 2 (continued)

B. Is he the top man? Is he in the upper 25%?

C. Does this fellow set a good example? How is his attendance record? Does he often come in late? Have foreman check records if possible.

D. Let's suppose something is bothering the group—would he be likely to come in and discuss it with you?

E. At times, an employee disagrees strongly with instructions on policy. What does he do in a case like this?

F. Some people accept instructions and orders readily, others reluctantly. Does he have a tendency in either direction?

4. JOB KNOWLEDGE—*Consider his knowledge of the job he is doing and his general knowledge of the whole process.*

Questions:

A. What jobs has he done?

B. Is he familiar with the over-all process of which his job is a part?

C. If other men in the unit are out, can he step in and perform their jobs?

D. As far as you know, is he familiar with any jobs in other parts of the plant? If so, which ones?

E. Where is he strongest in his job knowledge? Give example.

F. Where is he weakest? Give example.

Over-all Impression: (Comments)

Over-all Rating_

Poor Risk *Adequate* *Outstanding*

Supervisor's Signature_

5. A candidate is given a thorough medical examination to determine whether or not he can meet the rigorous physical requirements which attend a supervisory position.
6. The information obtained in the steps above is then summarized on an individual data sheet (Exhibit 3).

Exhibit 3

FOREMAN CANDIDATE–INDIVIDUAL DATA SHEET

Name ____________ Age ____

Medical Status: ____________ Years with Monsanto ______

Marital Status: ____________

No. of Children ____________

	PROFILE		
Factor	Poor Risk	Average	Outstanding
Alpha 9 Percentile	•	•	•
Mech. Comp. Percentile	•	•	•
Comp. Interview	•	•	•
Dept. Evaluation	•	•	•

EMPLOYMENT HISTORY: MONSANTO

From	To	Department	Job Title	Level

EMPLOYMENT HISTORY: OTHER COMPANIES

From	To	Name of Company	Job Title	Reason for Leaving

EDUCATIONAL BACKGROUND

Length of Time	School	Date of Graduation

REMARKS: ____________

7. A file is prepared for each candidate which includes all available data concerning his qualifications as a potential Plastics Division foreman.
8. To provide a meaningful picture of the relative merits of the candidates, a numerical value is assigned to each of the major areas investigated. These areas are the Alpha 9, Mechanical Comprehension, Interview, and Department Evaluation. This information, along with other data, is put on the general classification sheet (Exhibit 4), starting with the men who scored highest. This allows us to spot more quickly those men who should be given further consideration.

We recognize that the translation of intangible factors into numerical scores is always a difficult process at best. However, if we diligently avoid making final selections on the basis of numbers alone, the numerical scores can prove to be a useful tool.

Exhibit 4

GENERAL CLASSIFICATION SHEET—FOREMAN CANDIDATES

NAME	AGE	YEARS WITH MONSANTO	EDUCATION		ALPHA 9	MECH. COMP.	COMP. INTERVIEW	DEPT. EVAL.	TOTAL SCORE	COMMENTS

Alpha 9 and Mechanical Comp.

Upper 3rd	25 pt.
Middle 3rd	15 pt.
Lower 3rd	5 pt.

Comp. Interviews and Department Evaluation

Outstanding	25 pt.
Average	15 pt.
Below Average	5 pt.

9. Using these data as a basis for their decision, the plant manager and the general superintendents advance the most qualified individuals into the foreman selection pool from which future selections will be made. Those not placed in the pool as candidates are informed by the Personnel Department as to why they were not selected.

Results

Since June, 1951, the Alpha 9 and Mechanical Comprehension tests have been given to 139 wage employees who wanted foreman positions. Of this number, 92 were screened out because of failure to score adequately in the tests, for medical reasons, or because they voluntarily dropped out after having been briefed on a foreman's job requirements. Thirty are currently in the foreman pool, and 17 have been promoted to assistant foreman. Some important results of this plan are very apparent:

1. *Psychological Effect on Workforce.* The reaction of the wage group has been unusually good. This is undoubtedly due to employees' understanding that selections are now made on the most objective basis possible. Favoritism is out.
2. *Union Acceptance.* Management now has a complete picture to present to the union in support of its selection. This is particularly important when a man of few years' seniority is selected on the basis of outstanding ability. While management has the right to make the final decision concerning promotions, union acceptance of the man in question is important to all concerned.
3. *Supervisory Responsibility.* As a result of their greater participation in the selection of the new man, and their increased awareness of his background, supervisors have taken a special interest in the development of the individuals selected under the plan. Every attempt is made to assist the new man in his transition from the hourly ranks.

Not all of the problems associated with the merger or acquisition of organizations are financial. Many are concerned with the human problems, with the effect of the change upon the people involved. In many cases, these human problems have a greater effect upon the success of the merger than the financial factors. The former are less capable of accurate definition, longer lasting, time-consuming, disrupting to internal harmony and painful to all concerned.

The chemical process industries, because of the large number of mergers and acquisitions undertaken in the past ten years, is especially concerned with the problems arising from such activities. In many cases, through the exercise of discretion and foresight, the human problems have been minimized. In other cases sheer good luck and a rapidly expanding market for the firm's goods (the latter creating such broad promotional opportunities for all individuals that other personnel problems become trivial) have caused personnel problems to be obviated. In still other cases, however, corporate indigestion has followed the merger—this has been reflected in such outcomes as dissension, lowered profits, poor corporate image, and stockholder complaints.

The human problems which might arise are not limited to any particular level in the firm's hierarchy. This is brought out in the following case, which demonstrates how a well-reasoned and moderate approach to the human problems of a merger (that of Stauffer Chemical with Victor Chemical) can successfully avoid personnel difficulties.

This selection was written primarily to describe the merger's effects upon top management, but it also shows how all personnel will be treated. Stauffer's approach is one that is sure to minimize any of the human problems that are likely to occur, and will probably avoid most of them.

32 Stauffer-Victor: Formula for a Blend

from Chemical Week

With negotiations and paper-signing now behind it, management at Stauffer Chemical Co. is pushing the real work of making its merger with Victor Chemical tick. Basically it is a job of effectively blending two groups of relative strangers.

Agreement to merge the two organizations was made last July, and stockholders ratified the proposal at a special meeting Oct. 27. Merger became effective Nov. 1, when basic changes were revealed. Actual physical changes are surprisingly few, but a view of them is important to understanding how Stauffer assimilates its acquisitions.

Underlying the mechancis of the move is Stauffer's divisional setup under which Victor was brought in as Stauffer's ninth division. Changes were made in accordance with this policy, and because of Stauffer's reliance on some centralized staff functions (e.g., for company finances and marketing policy, among others).

The Victor setup fitted into Stauffer's picture with a minimum of realignment. A glance at the chart on the opposite page shows how this happened. At the top level (the board of directors), August Kochs, former board chairman of Victor, became vice-chairman of Stauffer, a position created to accommodate the merger.

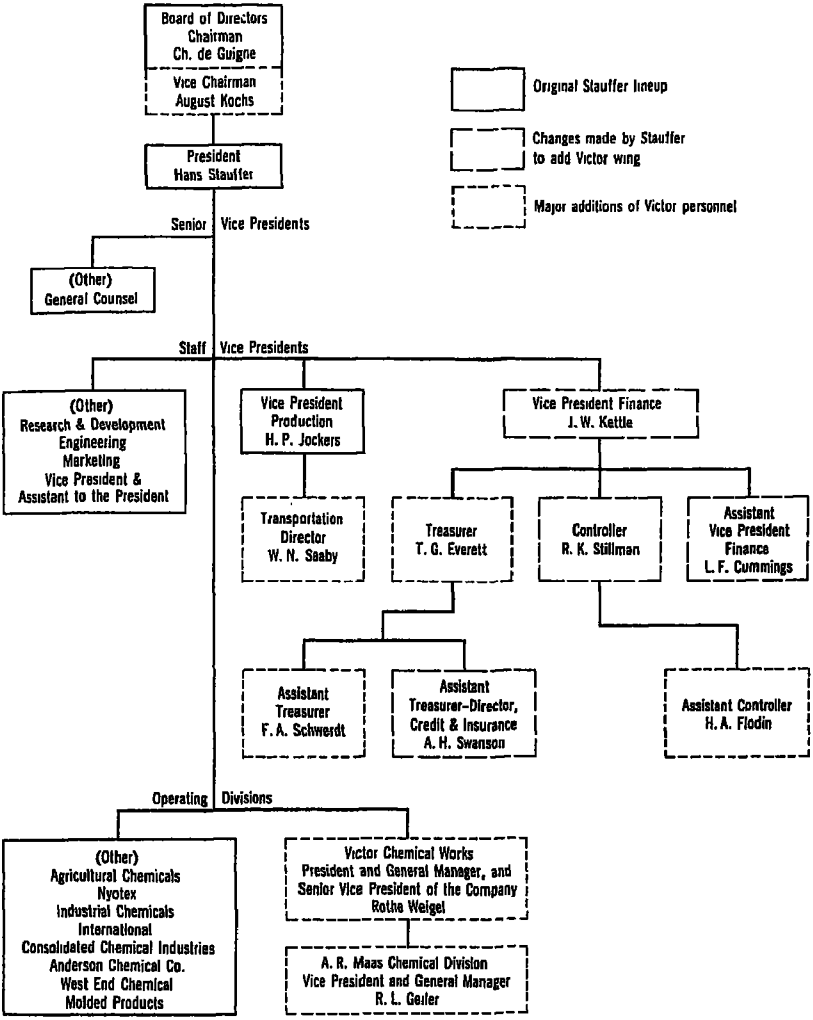
Second man in Victor's lineup, President Rothe Weigel is president and general manager of the Victor Division, also takes on the functions of a senior vice-president of Stauffer.

Because of Stauffer's reliance on some staff operations, the widest range of moves was to bring Victor financial men out of the divisional setup and into Stauffer's staff. To do this, Stauffer made several changes in its own organization.

At this level, the title of J. W. Kettle, Stauffer's treasurer and controller, was changed to vice-president—finance, Assistant Controller Richard Stillman was promoted into the controller's seat, reporting to Kettle, and former Victor Controller Herbert Flodin moved into Stillman's old job. At the same time, Stauffer's combination assistant secretary and assistant treasurer, Lloyd Cummings, became Kettle's assistant vice-president.

To these moves add Victor Financial Vice-President Tolman Everett, who became Stauffer's treasurer, reporting to Kettle, while Everett's for-

Reprinted with permission from *Chemical Week*, Vol. 85, No. 24 (December 12, 1959), pp. 94–96.



mer treasurer became assistant treasurer. Also on Kettle's staff is Arthur Swanson, a Stauffer man and formerly director of credit and insurance, now an assistant treasurer as well.

Elsewhere in the staff offices, Walter Saaby, formerly director of traffic for Victor, moved over as traffic director of Stauffer to fill the job vacated by the former director, who had planned to leave Stauffer, but had stayed on until the merger became effective.

At the divisional level, few job changes have been made except to bring operating and divisional staff jobs into alignment with other Stauffer divisions. However, one divisional change of significance involves Victor's A. R. Maas Chemical Co. division, which largely deals in photographic chemicals. Maas takes on the operating status of a Stauffer division; for purposes of administrative continuity, its chief, Raymond Geiler, became vice-president and general manager. He reports to Weigel, whose familiarity with the Maas operations makes it useful for him to administer its activities.

Internal Shifts

While it was adding Victor to its structure, Stauffer took the opportunity to make some long-contemplated internal changes. Top on the list was the elevation of Samuel Emison from his old job of sales vice-president for the Industrial Chemicals Division to a staff vice-presidency in marketing.

The marketing post had existed for some time, but Stauffer had never filled it. Essentially it calls for coordinating marketing policies of the various divisions, providing a corporate view of the various divisions' marketing activities. In addition to the marketing change, Stauffer revised one staff office's responsibility—from coordinating activities on the West Coast to a West Coast sales function. Any other internal changes resulted from such moves as those.

Minimum Uprooting

The blending of these two organizations with a minimum of dislocation points up the importance of merger-minded organizations' making a thorough study of their compatibility on points beyond product or raw-materials integration. Putting together the $152.3-million assets of Stauffer and the $48.3-million assets of Victor greatly enhances Stauffer's position in the sulfur, phosphorus and boron chemicals business, of course. But a major item in bringing the two firms together was undoubtedly the ease with which they could be merged.

That factor brings out an underlying concept in Stauffer's philosophy of effecting a merger. Stauffer has merged four other companies into its organization, some of which came in prior to the company's reorganization along divisional lines in '56. Stauffer's concept: tidy organization charts may look great, but merging must be done with minimum dislocation of the human factors involved.

Stauffer, therefore, has always stepped lightly in completing its merging moves. In Victor's case, it made only the most necessary moves to bring

Victor into alignment with its own structure. There are still other actions to be taken, of course, but these may not come for some years. In fact, according to A. E. Albright, a Stauffer vice-president and assistant to the president, there are still some matters hanging over from previous mergers that haven't been resolved because of the human factors.

In the Victor merger, an example of these factors can be found in company policies respecting pension plans, industrial relations, public relations, insurance coverage, contributions to charity and education, etc. For the time being, Albright points out, Victor's policies will remain largely intact on these points, with only minimal changes in prospect. Later, as the new organization functions smoothly with Stauffer's, greater uniformity may be sought.

This same cautious attitude has applied before, Albright says. West End Chemical Division, for example, which was merged into Stauffer in '56, still has its own pension plan. And, for instance, Stauffer will pass along to Victor a monumental tome containing what it calls Standard Practice Bulletins that outline exact procedures to be followed in almost any imaginable instance. But the company will not call upon Victor people to use it until they become more adjusted to the Stauffer organization.

Naturally, some staff functions will remain in the divisions. Victor will handle its own internal accounting, and will conduct its own specialized purchasing as well as advertising activities.

Industrial relations, too, remains largely in divisional hands, so that special situations can be met to fulfill Victor's own divisional requirements.

For now, Stauffer has made all the changes it intends to make to bring Victor smoothly into its fold without disrupting the stature or responsibility of individuals.

How such a concept may work out over the long haul remains to be seen. Certainly in the new merger, it may not be assessable for a long time. At first blush, however, it appears that Stauffer has achieved the Victor merger with more tranquillity than is generally the rule in affairs of this kind.

At periodic intervals it becomes necessary for an employer to renegotiate a labor contract with the representatives of his employees. The employer may bargain with partial groupings of his employees, e.g., chemical operators, instrument technicians, maintenance mechanics, or he may bargain with all the workers' groups associated as one comprehensive industrial unit. The number of potential bargaining arrangements multiplies rapidly for a company that has more than one plant, and multi-plant facilities are a commonplace in the chemical process industries.

Under the Taft-Hartley Act of 1947 the National Labor Relations Board is empowered to determine the scope of the bargaining unit. Whether the NLRB will include all or several plants of an employer in a single bargaining unit or will order the establishment of a separate bargaining unit in each plant generally depends upon the factors surrounding the specific case. In brief, the customary bargaining arrangements used by the company, together with the degree of similarity of the various plants' activities and their geographic locations, weigh most heavily in the decision of the NLRB.

As a bargaining stratagem, it is usually to the union's advantage to seek the largest possible bargaining unit, while it is to the company's advantage to deal with a single plant unit rather than with a multi-plant or industry-wide labor unit. Since the average local labor unit has neither the financial nor skill resources to deal with a large multi-plant corporation, there is constant union pressure upon firms, and this includes those in the CPI, to widen the bargaining unit. Although the CPI's branches have substantially resisted these union pressures, nevertheless company-wide units are now common in both the rubber and the iron and steel industries. And, going beyond this in scope, industry-wide units are used for bargaining purposes in the glass industry.

The following two selections outline the experience of two large CPI firms, Linde (a Carbide division) and Cyanamid, in dealing with union demands for multi-plant negotiation.

33 A Case Study: The Linde Strike

by Alan D. Stackpole

Linde Company, a division of Union Carbide, is one of the larger producers and distributors of industrial gases. It supplies oxygen, nitrogen, argon, acetylene, and other gases directly to large users and, through distributors, to smaller users. It has plants in all the principal industrial centers in the country. In addition to the plants handling gases, the company also has several factories where welding and cutting equipment, cylinders, and equipment for its gas plants are made.

Linde and the Unions

Linde has more than 60 contracts with labor unions. It deals with eight different AFL-CIO international unions, with two international unions not affiliated with the AFL-CIO, and with two independent local unions. Each of these unions, or its local, was certified by the National Labor Relations Board as the bargaining agent for employees at one specific plant location; this is an important point. Because of the nature of the business, its plants are small insofar as numbers of people are concerned. Only a few locations have enough employees to justify an industrial relations or personnel department. As a result, local managers are assisted in their negotiations with unions by representatives of Linde's Industrial Relations Department located in New York.

Over the years, Linde has endeavored to stagger the expiration dates of its contracts. This was not done because it had any illusions that such a course would prevent union pressures for multi-plant bargaining; it was done out of sheer necessity, in order that a comparatively small group of negotiators could cover the ground. An average of five contracts per month is a fairly heavy load.

For over 10 years, there has been in existence a somewhat loose confederation of union groups known—for most of the time, at least—as the "Carbide Council." This group had its genesis in a local of the Gas, Coke and Chemical Workers (CIO) at Linde's Tonawanda factory. In its earlier days, the Council tried unsuccessfully to get Union Carbide to bargain on a multi-company basis. After a period of comparative inactiv-

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Reprinted with permission from *People At Work: The Human Element in Modern Business* (New York: American Management Association, AMA Management Report No. 1, 1957), pp. 63–66. Mr. Stackpole is General Manager of Industrial Relations at the Union Carbide Corporation.

ity, the Council took a new lease on life. Enlisting the support of other unions, it let it be known that it was interested in negotiating eventually with Union Carbide rather than with the individual plants of Carbide's divisions.

Steps Leading to the Strike

To avoid confusion, we shall discuss only four of the locations involved in negotiations with the Oil, Chemical and Atomic Workers (AFL-CIO), or "OCAW," out of the 13 Linde plants which have contracts with that union.

The plants in Youngstown, Ohio, had contracts expiring on October 1, 1956. Negotiations proceeded in a normal fashion, but agreements were not reached. The deadline passed, no extensions were made, and the employees continued to work. There was no strike, nor was there any talk of a strike.

Shortly after the expiration date of the Youngstown contracts, negotiations were begun at both Essington and Kittanning: Essington is outside of Philadelphia and Kittanning is at the other end of Pennslyvania, north of Pittsburgh. The Essington negotiations appeared to proceed in a normal fashion. There were disagreements, but there were also many points on which both the company and the union were able to get together. At Kittanning, we had a somewhat different picture. Linde negotiators found it difficult to arrange meeting dates which were satisfactory to the union representatives. When meetings were scheduled, much time was lost in reviewing and rehashing items which had been thoroughly discussed at previous meetings. The negotiators found it difficult to reach definite agreements on any specific items which were discussed. There appeared to be a definite effort on the part of the union not only to delay negotiations but to avoid settlements on any issues whatever. At both Essington and Kittanning, the expiration dates of the contracts were reached and passed, but still no strike occurred. It is interesting and significant to note that at the Essington negotiations—which had proceeded in a more or less normal fashion, as previously mentioned—a complete agreement was reached with the union negotiating committee and the international representative on *two* occasions. The contracts, however, were not ratified by the employees. In both instances, representatives of the international union appeared at the ratification meeting and, we understand, successfully persuaded the employees not to ratify the agreements.

We thus had three plants which had the passed the expiration dates of their contracts with no agreements reached. A fourth plant, at Tonawanda, New York, with many more employees than all of the other plants combined, had a wage reopener on January 23rd. It was obvious to Linde that no agreement would be reached at Tonawanda unless satisfactory agreements were arranged at the other three locations, and, after negotiations started at Tonawanda, it was obvious that a reasonable settlement would not be readily accepted there. After only two real negotiating sessions, the Tonawanda plant was struck at midnight of January 23rd. The Kittanning and Essington plants were struck on January 25th. The Youngstown plants did not strike immediately, but on February 4th they too were shut down. The strike lasted until May 13th, a total of 108 days. Individual contracts on the basis of local settlements were signed in each case, with no agreement whatever with respect to bargaining on a multi-plant basis on *any* subject.

Management's Recourse

It should not be thought that Linde was uninterested in taking steps to prevent more than one of its plants being struck at one time, for it had a lot at stake. When the objectives of the OCAW became obvious, employees at the several plants were told by the local managers that strikes were inevitable if the union persisted. At the same time, the possibility was considered of closing each plant if the deadline was reached without agreement.

Most contracts have "no strike, no lockout" clauses. The public believes, generally, that the right of a company to lock out is equal to and parallel with a union's right to strike: It seems reasonable that each should have an equally powerful weapon. But such is not the case under our present labor laws. Even if it had been willing to close plants running at capacity, Linde came to the conclusion that it could not lock out without running the risk of incurring a charge of unfair labor practice, with liability for back pay to those employees who were prevented from working. The American Brake Shoe case and the Buffalo Laundry case facts were totally different from those involved at Linde.

Where do these facts leave a company faced with a demand—expressed or hidden by other issues—to bargain on a multi-unit basis? Staggered expiration dates are no comfort. A lockout is possible only under exceptional circumstances. If management believes strongly enough in its principles and in what it considers to be best for the company, however, it can say "No." It is possible to *take* a strike and *win* it. Some may say that a strike is too high a price to pay to avoid taking this first step down the road toward bargaining at the company or division level: *What's wrong* *with the idea of getting all of this hassle behind us in just one top-level negotiation? Why does Linde insist on bargaining on a plant-by-plant basis?*

Let's make two assumptions: first, that companies are willing to make fair and reasonable offers at the bargaining table, or are willing to meet fair and reasonable union demands; and, second, that unions have reached a position of economic strength which permits them to deal with companies on at least an equal basis. If we accept these assumptions, we must conclude that those decisions of a company which assist a union must react to the disadvantage of that company.

Thus, I submit that the answers to the two questions previously posed are provided by the OCAW itself in the following excerpts from the August 5, 1957, issue of its official paper, *Union News:*

> The company or industry council provides the most effective instrumentality available to us in this area (benefit plans) in view of our lack of 100 per cent organization.
>
> Plant-level negotiations strengthen the position of companies, . . . and the average local, even with the assistance of the international union, is simply not equipped in terms of economic strength to deal with the areas of company policy administered on a company-wide basis.
>
> We realize . . . that an increased role of the international union in collective bargaining may be looked upon as a limitation of local union autonomy. The opposite is true. Under our present local plant bargaining arrangements, local autonomy in negotiations is, in reality, a restriction on the locals, since they are actually unable to compel the companies to effectively negotiate on matters of great importance to our members. For this reason, the collective bargaining role of the international and [of] company and industry councils should be substantially increased.

34 American Cyanamid Makes an Exception

by R. P. Fisher

American Cyanamid celebrated its fiftieth anniversary in 1957, and its gross sales are now over the $500-million mark. Of the company's approximately 27,000 employees, who work in 46 plants scattered throughout the United States and Canada, almost 12,000 are covered by union contracts. We now have 49 contracts with 15 different international unions, and the size and scope of the bargaining job have definitely influenced our reactions to certain proposals for company-wide bargaining. Our position, in effect, is this: We are against master contracts and company-wide bargaining, as such. This year, however, we decided to bargain jointly on a company-wide basis on our pension and insurance plans with two unions which represent approximately 60 per cent of our hourly employees in 21 of our plants.

Reasons for the Decision

This decision was not made suddenly. The International Chemical Workers (ICW) had been pushing this step at us for three or four years, and we had been sidestepping it as part of our policy of not getting into company-wide bargaining in any area. However, it is our opinion that management policies should not become so hidebound and restrictive that they cannot be adapted continually to the major, over-all interests of the company. Accordingly, we made the decision for three reasons, as follows:

1. Vital policy decisions had begun to "bump into one another" with regard to our pension and insurance plans. For one thing, Cyanamid has a definite objective for the constant reappraisal and review of its employee benefit programs in order to make sure that these programs are keeping in step with the times and that they represent the kind of progressive management practices that we wish to maintain. This year, after months of study, we were ready to propose certain changes in our

Reprinted with permission from *People At Work: The Human Element in Modern Business* (New York: American Management Association, AMA Management Report No. 1, 1957), pp. 69–71. Mr. Fisher is Manager of Labor Relations at the American Cyanamid Company.

pension and insurance benefits which, in our opinion, represented considerable improvements over the plans existing then.

2. We felt that pensions and insurance benefits should be available to everyone in the company. This approach of equitable treatment was seen to be essential for a sound employee relations program.
3. Negotiating the numerous technical points of the proposed new benefit program at the local level in 46 different plants would have presented a tremendous organizational problem. Of course, we did get into considerable discussion of some of the changes involved at local bargaining tables, but unilateral bargaining on all points would have been time-consuming and, perhaps, futile. Inasmuch as we wanted to have the proposed changes apply to all of our employees, it made sense for all concerned to deal with this highly technical union negotiation on a unified basis.

Working this program out with the various union groups gave us the opportunity to make very clear just where we would draw the line on company-wide bargaining. We agreed to bargain with any union for the employees it represented in the specific area of pensions and insurance, but we would not discuss any other subject in the fringe benefit area, the wage area, or any other area. We remain firm in our position that any and all subjects other than pensions and insurance shall be considered at the local plant level.

This Far . . .

A small task force of four members of management was established to review our pension and insurance plans and compare them with other plans in the chemical industry. We studied the demands that had been made by our various unions at local plant levels and those submitted to us by a joint committee of the International Chemical Workers and the Oil, Chemical and Atomic Workers (OCAW). We checked to see if our insurance plan provided adequate coverage in all areas where we operate our plants, and we eventually came up with a number of recommendations for consideration by our top management people. It was kept in mind that these recommended changes would apply to *all* Cyanamid salaried and hourly employees, not only to those represented by a union. Naturally, the cost of these recommended changes was given serious consideration, but approval was received and we were ready to bargain with the unions.

The ICW and the OCAW appointed a joint committee, and our negotiations with this group lasted about one year. Not all 21 locals which these two unions represent had membership on this joint committee, and our immediate concern was whether or not this committee had authority to bargain for these locals, and whether any agreement reached with said committee would be acceptable to each local and its membership. The unions subsequently submitted letters from each local authorizing the joint committee to negotiate for them and stating that any agreement reached with the joint committee would automatically apply to the members of all locals.

The negotiations were held in New York, with union representatives coming from as far as Florida and Louisiana at their own expense. We paid for the hotel rooms and the coffee. Both international unions had a research director and two international representatives who headed the joint committee; this made a total of 25 on the committee. Agreement was finally reached on April 18, 1957, and a memorandum of agreement was signed on June 26, 1957. The changes in both plans became effective July 1, 1957.

Having made definite decisions as to just what improvements we would make in these plans, we decided to announce these improvements to our salaried employees at the time the last meeting was held with the union on April 18, 1957. A letter from the president was sent to each salaried employee at his home, stating that certain improvements would be made in the near future and that more detailed information would then be announced. We felt that the timing of the announcement was important for the salaried employees' morale, and we had every reason to believe that we would reach agreement with the union at the April 18th meeting.

Uniformity was maintained for all other employees, even though many of the contracts with other international unions required the union's agreement in order to make these same changes. This was possible because our plans—even without the changes—compared very favorably with any in our industry and in industry as a whole; in view of the improvements which we were making, the plans were readily acceptable to all locals and all other unions.

. . . and No Farther

We are opposed to company-wide bargaining, yet we have agreed to it in one area. The obvious question is, "Where do we go from here?" Ours is a multi-plant, multi-product, multi-union company, with contracts which have no common expiration date. Although we are most aware of the stated intention of the two unions I have mentioned to force us ultimately to agree to company-wide bargaining—at least for those plants which they represent and at least in the areas of fringe benefits and wages—we shall earnestly and forcibly resist any further move in this direction in the future.

Part Four

Marketing Policies in the Chemical Process Industries

Sound marketing policies are necessary to the effective operation of the enterprise. Such policies serve as guidelines to channel the thinking and actions of those who must make decisions. Policies can be broad in scope and applicable for the company as a whole; for example, such a policy may require that all marketing units of the firm provide at least as much technical service as the unit's strongest competitor. Or, policies can be minor in nature, applicable to only a small segment of the firm's organization. For example, there may be instituted a policy of not spending any money on advertising in the lubricating oil additive department; the intent may be to milk this particular segment of all possible profit and then discontinue the manufacture of these additives.

There are many marketing policies that exist in the average chemical enterprise; such policies concern, for example: pricing, advertising, sales promotion, customer service, market position, company image, full line or partial line, new products, old products, delivery, warehousing, market research and marketing organization. These policies, however, must be consistent in that they *all* seek to further the ultimate objectives of the enterprise.

It is not always obvious that a certain plan will realize the enterprise's aims. This occurs most frequently when the firm must take into account the policies and actions of its competitors when formulating its own plans. Such a modification of policy in response to the plans and policies of others is considered to be a *strategy*. One chemical firm, for instance, recently employed the strategy of retaining a certain product in its line just to make the market more difficult for a competitor, even though this product was unprofitable for them to produce by a number of yardsticks.

Policies are ordinarily couched in fairly nonspecific terms—they must be if they are to endure. Thus, it is up to the people whose job it is to make decisions to exercise judgment and initiative in applying these policies. The higher ranking executives will be able to make broader policy interpretations than those below them in the firm's organizational hierarchy.

The task of properly applying a policy to a specific case, then, is not an easy one. It requires, first of all, that the individual know just what his firm's policy is. Since the master policies are frequently not written, but passed on as the verbal tribal lore of the enterprise, this knowledge is not always available. Second, each interpretation of policy made by those higher in the organization's hierarchy tends to obfuscate, embellish and change the original policy; this too makes it difficult to fully understand the firm's basic policy. In addition to these uncertainties about what the policy is, the individual frequently does not know just how much authority he has to interpret it. If he goes too far in deriving a subsidiary plan of action based upon a firmly established policy he may be censured for exceeding the limits of his authority. If he does not go far enough in formulating a specific plan based upon the firm's policy he is subject to the criticism of lacking initiative, drive and imagination. Third, it is not always easy to transform a policy into an effective strategy since one's knowledge of the competitor's plans is ordinarily incomplete. Finally, effective policy utilization and action require experience in making the type of judgments that are essential in their use.

It is the purpose of this section of the book to provide a variety of illustrations concerning marketing policies of chemical industry firms in order to provide the insights necessary for the effective formulation of such policies. Thirteen selections have been chosen from a wide scope of sources. These illustrate policies in such areas as advertising, pricing, and customer service.

The following case discusses some aspects of the Aluminum Company of Canada's recent venture into the production of aluminum pipe and tubing. The authors trace Alcan's strategy in handling this product line over a one year period. This time span covers the project from the time that a pre-production business survey was made to the time that initial sales results were available.

A number of important problems are outlined which demonstrate some of the thinking necessary to launch a new product. For one, the case emphasizes how important it is to select the proper distribution system for the product. For another, it shows how the advertising and sales promotion policy is formulated and carried out.

Many questions are raised for which no answers are given. This is the reader's job. For example: is it wise to stick with "old and reliable" distributors even though they may not be able to satisfy the customers' needs?; should Alcan enter this entire venture on the basis of a marginal economic analysis, one which apparently has not allocated and considered *all* of the costs of the venture?

35 Aluminum Company of Canada Limited

by David S. R. Leighton and David H. Thain

Part 1

In early 1957, executives of the Aluminum Company of Canada Limited were considering whether the company should enter the industrial pipe and tubing market. While the company had been fabricating a wide line of tubular products such as aircraft components, irrigation tubing, garden furniture tubing, electrical cable sheathing, ice rink tubing, and semi-rigid

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gas connection tubing, no attempt had been made to fabricate and sell industrial pipe and tubing. It was felt by some members of the company, however, that in addition to these products, a large potential market existed for an aluminum pipe product primarily for quick-coupled unburied water and air lines in mining and construction applications. On the basis of the information then available these officials felt that the company should begin the production and sale of industrial pipe and tube[1] immediately.

Alcan, the major operating subsidiary of Aluminium Limited, employed close to 18,000 people in Canada in 1956. One of the world's largest producers of aluminum ingot, the company had at that time a total annual ingot production capacity of 770,000 tons. Alcan also fabricated a small portion of their ingot production.

Second only to iron in annual metal consumption, aluminum was the largest selling non-ferrous metal in 1957. The growing variety of uses for aluminum stemmed from the increasingly successful application of its properties, which included light weight, corrosion resistance and high electrical conductivity. Most of Alcan's aluminum was exported to various parts of the world at the time. In 1954, for example, about 50% of all Canadian ingot produced was sold outside the North American continent and about 35% went to the United States. Approximately 15% was retained for domestic consumption, one-quarter of which was sold in ingot form to non-affiliated companies for fabrication.

Although Alcan entered nearly all phases of aluminum semi-fabrication to some extent, these fabricating activities were not so extensive as to utilize a large portion of the virgin ingot produced. Among the fabricated products produced by Alcan were wire, rod, cable, cable accessories, extrusions, sheet, foil, plate, tubing, forgings, rolled rod, aluminum paste, and castings.

Alcan's sales force sold all the company's products to both large end-users and to the company's three distributors, who in turn resold them to the many small end-users across Canada. There were 52 members in Alcan's field sales organization. Of this number, 32 were general salesmen selling all the company's products, and 14 were either product or industry specialists in the district offices selling a limited number of products. There were six district managers.

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[1] The major distinction between pipe and and tube is the manner of dimensions. Tube sizes are dimensioned according to outside diameter, whereas pipe sizes are dimensioned according to inside diameter. For example, a two-inch pipe is two inches inside diameter, whereas a two-inch tube is two inches outside diameter.

Alcan's own sales force was assisted by the sales forces of three metal goods distributors in selling semi-fabricated products in Canada. These distributors maintained sales offices across the country and sold a wide line of metals including carbon steels, stainless steels, specialty steels, aluminum, brass, and copper. These metal distributors sold to small and medium-sized metal users in Canada. Mill orders were turned over to Alcan for direct shipment and smaller orders received by Alcan were turned over to the distributors for filling.

As a result of a general decline in business activity, increased Russian exports of low-priced aluminum ingot to the United Kingdom, and increased smelting capacity in North America by Alcan and its competitors, the company was reported to be producing at considerably less than capacity in 1957. Thus there was substantial pressure on all divisions of the sales department to increase sales of aluminum either by encouraging present customers to take more aluminum, or else by finding new end-users. Company personnel were then working on the promotion of new uses for aluminum in the production of fabricated products, including wire and cable, irrigation tubing, truck bodies, roofing and siding, architectual aluminum, and industrial packaging foil. It was felt by some of the sales department personnel that the industrial pipe and tube market would offer Alcan another large new end-user for aluminum.

Aluminum pipe and tubing was manufactured from aluminum ingot in two stages, extruding and cold drawing. Extrusion was the process whereby a heated cylindrical ingot was forced through a shaped opening in a steel die. If the mechanical properties and dimensional accuracy requirements of the product could be met by the extrusion process alone, no further fabrication was necessary. In the fabrication of most products including tube, a second step, cold-drawing, was necessary. Cold-drawing of the extruded tubing hardened the metal and enabled closer dimensional accuracy of the finished pipe or tube.

It was thought that aluminum had several characteristics that would make it more desirable to some industrial users than the steel products then being used. The potential advantages of using Alcan aluminum alloy industrial pipe and tubing were listed by one Alcan official as follows:

1. Low cost (see Exhibit 1).
2. Light weight; one-seventh weight of standard steel pipe; approximately one-quarter weight of light wall steel pipe and spiral welded steel pipe.
3. Corrosion resistant.

Exhibit 1 Comparison of Aluminum Pipe and Tubing Price per 100 ft. with Competitive Products by Area[a]

Trade Size	Company A Competing Steel Sizes	Company A Prices per 100′ F.O.B. plant	Company A Price per 100′ Laid down Ont. & Que. Mining Area	Forecast Alcan Prices per 100′ Laid down Anywhere in Canada	Company A Prices per 100′ Laid down Western Oil Field	Steel Jobber Price
2	2.375 × .083	$ 35.30	$ 37.79	$ 41.10	$ 40.11	$ 52.34
3	3.500 × .083	51.22	55.93	74.68	59.30	106.00
4	4.500 × .188	119.56	132.83	94.79	145.14	170.00
6	6.625 × .188	170.99	190.11	218.89	207.98	277.00

[a] Based on lot size orders of under 5,000 lbs.

4. Great strength and ease of handling.
5. Speedy to assemble and dismantle.
6. Greater flow capacity due to increased bore compared with standard steel pipe and also less pipe friction.
7. Mechanical properties improve at low temperatures.

In view of these product characteristics company officials believed that the proposed product could best be used as a high pressure pipe or tube for above-ground portable or semi-permanent pipe lines. The following applications were tentatively suggested for the product:

1. Compressed air lines.
2. Water supply lines.
3. Fire fighting lines.
4. Fluid flow lines for food and chemical industries.
5. Crude oil flow lines.
6. Vent pipes.
7. Gas gathering lines.
8. Fuel lines.

Other possible uses for aluminum pipe and tube included a wide range of general structural applications. These included lamp standards and brackets, idler rollers for conveyors, handrails, and pneumatic tubes.

According to Alcan officials, aluminum industrial pipe and tube could be sold to the following industries: construction, pulp and paper, electric utilities, oil and gas exploration and production, mining, lumber, wineries, flour and feed mills, and transmission pipelines. The company had two surveys done, one in 1954 and the other in 1956, in an effort to determine the potential market for aluminum industrial pipe and tube. These surveys were designed to study the needs of the most important industrial buyers only, and were not intended to represent an exhaustive study of the total Canadian industrial market for aluminum pipe and tube. The studies indicated a potential market in construction, mining, oil and gas surface lines of 320 tons in 1958, 500 tons in 1959, and 1,000 tons in 1962.

These industries were then using a variety of products to satisfy their pipe and tube requirements. Black iron pipe was most widely used, followed by steel and steel alloy, asbestos, plastic, brass, imported aluminum, and various other special purpose alloy pipes and tubes. These existing products were being widely distributed in Canada by manufacturers, metal distributors, industrial wholesalers, and pipe and tube jobbers. There were several hundred distributors of pipe and tube in Canada at the time.

A relatively small volume of aluminum industrial pipe and tube had been sold in Canada for several years prior to 1957. The Nationwide Supply Co. Ltd., a major supplier of machinery, equipment and supplies to the mining and construction industries, had sold over 200,000 pounds of aluminum pipe and tube in 1956 to industrial users who required a product with the physical and chemical properties of aluminum. The aluminum product they sold was imported into Canada from the United States and was believed to bear 22½% duty f.o.b. the Canada-United States border. In addition, the importer charged a markup estimated at 7½% on landed cost before selling it to the Nationwide Supply Co. Ltd., who added an unknown amount—probably in excess of 100%—as markup on their cost. The importer also sold a line of couplers (necessary for joining together the individual pipe lengths) which bore the same markups. Together, the aluminum pipe and couplers distributed in Canada by the Nationwide Co. Ltd. sold at a final price which was 100% above that charged for black iron pipe (Exhibit 2). Alcan officials hoped to offer their line of industrial pipe and tube at a price reasonably competitive with black iron pipe of the same size.

According to Alcan's engineering department, the company could begin the production of industrial pipe and tube with a small incremental investment of under $50,000, largely for dies. If the annual production of pipe and tube were to exceed 3.7 million lineal feet, it would be necessary for the company to install additional equipment and facilities at an estimated cost of $450,000.

The cost accounting department prepared the data shown in Exhibit 3 which showed the anticipated costs of fabricating, storing, and shipping industrial pipe and tube.

Exhibit 2 Prices of Compressed Air Pipe ($ per 100 ft.)

	Standard Black Iron Threaded and Coupled	*Galvanized Threaded and Coupled*	*Rubber Hose (Wire Braided)*
1" Car load lots	$ 16.68	$ 20.07	$105.00
Less than car load	—	—	
2" Car load lots	35.49	42.31	240.00
Less than car load	45.66	—	
3" Car load lots	71.72	87.49	530.00
Less than car load	92.32	—	
4" Car load lots	115.02	137.76	621.00
Less than car load	147.98	—	
6" Car load lots	188.28	238.66	—
Less than car load	242.25	—	

Exhibit 3 Forecast Cost Analysis of Producing and Shipping Industrial Pipe and Tube

	*Average cost per Lineal Foot**	*Average cost per Pound of Aluminum**
Manufacturing Costs:		
1. Variable Costs	$.298	$.233
2. Fixed Costs†	.191	.150
Warehousing and Insurance	.070	.055
Shipping Costs	.122	.088
Allocated Intra-Company Costs	.112	.088
Totals	$.793	$.614
Estimated Average Company Selling Price	$.8745	$.6831

* Based on the company's estimate of the proportions of the several pipe and tube diameters and wall thicknesses that would be sold, and based on aluminum lot-size shipments. All figures have been disguised.

† Estimates based on an assumption that all equipment would be operated at 70% of capacity.

Part 2

It became apparent to Alcan sales executives who studied the reports of the company's commercial research division on the market potential of aluminum industrial pipe and tubing, that the choice of distribution channels would be of key importance to the success of any attempt to capture a substantial share of the market. The company had well-established channels for most of its other fabricated products. As described in Part 1, Alcan's own sales force was assisted by three distributors in selling all the company's ingot and fabricated aluminum products. For this reason it seemed natural to some Alcan personnel that the company adopt the same distribution channels for industrial pipe and tube as were being used to distribute most of the company's other products. On the other hand, the reports issued by the commercial research department describing their investigation of the industrial pipe and tube market, stated that the company should adopt new channels for the proposed product. The people in the commercial research department claimed that their examination of the buying habits of industrial pipe and tube users had revealed that the prospective customers for these products would expect to buy their requirements from their regular local supply houses. Therefore, company officials were trying to decide whether to appoint their regular distributors to handle industrial pipe and tube, or whether in this case an exception should be made by the appointment of several new distributors.

Alcan's own sales force sold all the company's products to both large end-users and to the company's three distributors—who in turn resold them to the many small end-users across Canada. The company's salesmen all had university backgrounds, and in many cases had done some graduate work. Most of them had studied engineering at university, and had received little sales training prior to joining the company. Upon joining the company, however, they were put through Alcan's indoctrination sales training program before being transferred to the sales department. There were 52 members in Alcan's field sales organization. Of this number 32 were general salesmen selling all of the company's products, and 14 were either product or industry specialists in the district offices selling a limited number of the company's products. For example, one salesman was in charge of the road transport section of the sales department and was responsible for selling aluminum to that industry alone. The general salesmen were responsible for selling all the company's products (wire, rod, cable, cable accessories, extrusions, sheet, foil, plate, tubing, forgings, rolled rod, aluminum paste and castings) to the many end-users across Canada who were not otherwise covered by one of the product or industry specialists.

Alcan's own sales force was assisted by the sales force of the three metal goods distributors in selling aluminum ingot and semi-fabricated products in Canada. The three distributors were National Metals Ltd., Ryerson Metal Sales, and Jackson Ltd. The sales offices of these three distributors were located across the country. These distributors sold a wide line of metals including carbon steels, stainless steels, specialty steels, aluminum, brass, and copper. These metal distributors sold to large and small end-users. Alcan sold direct in large quantities only to metal users in Canada.

The three distributors had been appointed by Alcan on a non-exclusive basis to sell anywhere in Canada a line of Alcan products known as "Alcan Standard Warehouse Items". This general classification included almost all the products manufactured by the company. The distributors warehoused, handled, and packaged for resale all Alcan standard warehouse items. While the distributors solicited orders from, and sold to, any customer from their warehouse stocks, they normally referred large orders to Alcan for direct shipment, while Alcan normally referred smaller orders to its distributors. In addition to the above functions the distributors maintained trained personnel for the promotion and sale of aluminum.

While Alcan officials were not then using any jobbers of the type recommended by the commercial research department as being most suitable to distribute pipe and tube (i.e. local supply houses), they had some information on these companies and the services they generally performed. As shown in Exhibits 1 and 2, there were many specialized jobbers operating in Canada that catered to the needs of particular industries. These jobber-distributors were generally located close to the industrial users they served. They carried in stock a substantial proportion of the supplies and equipment that their customers regularly required. Often they

*Exhibit 1 Breakdown of Distributors to the Oil Exploration, Mining and Construction Industries in Canada, 1955**

Province	*Oilfield Services, Supplies and Equipment*	*Construction Equipment Dealers*	*Mining Equipment and Supplies*	*Mill Supplies*
Alberta	65	12	14	16
British Columbia	3	10	24	11
Manitoba	—	15	12	12
New Brunswick	—	10	3	7
Newfoundland	—	1	1	—
Nova Scotia	—	10	3	11
Ontario	5	61	98	86
Prince Edward Island	—	1	—	2
Quebec	1	39	58	45
Saskatchewan	5	10	4	6

*Source: Fraser's Canadian Trade Directory.

*Exhibit 2 Summary of Canadian Pipe Distributors, 1955**

Type of Pipe	Number of Distributors
Acid Resisting	21
Aluminum	5
Asbestos	2
Brass	7
Cast Iron	42
Conductor	26
Copper	17
Corrugated	8
Fabricated	16
Magnesium	2
Nickel	3
Plastic	27
Rubber-lined	9
Stainless Steel	12
Steel	40
Used Pipe	76

*Source: Fraser's Canadian Trade Directory.

would offer such services as repair work, rapid delivery, technological and industry information and credit arrangements; they would also obtain items not normally carried in stock. The specialized industrial jobbers serving the petroleum, construction, and mining industries generally obtained a margin of approximately 25% for their services. It should be noted that Alcan's regular distributors were national distributors and did not offer as many services or advantages to the industrial buyers as did the regional, specialized jobbers.

Company executives recognized that there were certain advantages to appointing the three regular Alcan distributors to handle the proposed aluminum industrial pipe and tube. Although the company had made clear to these distributors that they had not been appointed on an exclusive basis, a kind of informal agreement had developed over the years that Alcan and the three distributors would work together in marketing new products. This arrangement had come about because the three distributors had naturally become closely identified with aluminum products. In the case of pipe and tube these distributors indicated a desire to take on the new line, even though it was understood that Alcan might give the line to pipe and tubing jobbers as well, if it should so desire.

Alcan sales people had been trying for many years to ensure that aluminum was not being sold for application in jobs where it would not stand up under use. In this way it had been hoped that aluminum could avoid many of the adverse reports that often surrounded products being sold for uses for which they were never intended. Aluminum industrial pipe and tube was an unknown quantity as far as performance under many potential conditions was concerned. While Alcan's commercial research division had pictured a large potential market for aluminum pipe in the mining and construction industries especially, they had also pointed out that there had not, at that time, been developed any accurate information about the product's performance in these possible applications. For this reason the sales people wanted to be careful that aluminum pipe and tube was sold initially only for those end-users for which company engineers could guarantee satisfactory performance. Alcan's three regular distributors had cooperated fully with the company in similar situations in the past. It was not known, however, what control the company would have in this regard over any new distributors to be appointed.

At the time this matter was under consideration, aluminum pipe was already being sold in Canada by the Nationwide Supply Co., Ltd., manufacturer and distributor of a wide line of industrial and mining products in Canada. While Nationwide Supply operated a chain of sales offices across Canada, a major share of their sales was made through a chain of jobber distributors that had associated themselves with the company. It had been Nationwide Supply's policy to get the widest possible distribution for their products and they were willing to offer jobber discounts to any qualified distributors.

The Nationwide Supply Co. Ltd. had been the only large company to distribute aluminum industrial tube in Canada prior to the time Alcan decided to enter the market. In 1956 they distributed over 200,000 pounds of aluminum tubing to industrial users in Canada. The aluminum tubing they sold was imported into Canada from the U.S.A. This imported aluminum pipe and tube bore a 22½% duty, and markups totalling 100% by the importers and Nationwide Supply Co., who distributed it to end-users across Canada. Nationwide Supply Co. offered their chain of associated jobber-distributors a 25% discount from the suggested selling price. In summary, these margins were calculated as follows:

I	II			(*a*)
Price f.o.b. U.S.-Canadian border	*Importer*	*Nationwide Supply Co. Ltd.*		Suggested selling price
+ 22½% duty	+ 7½% markup on I	+ 100% markup on II	=	

Suggested selling price – 25% discount on selling price = Price to associated jobber-distributors (*b*)

The importing company also manufactured and sold the coupling devices necessary for joining the individual tube lengths. These also bore a 100% markup on the part of Nationwide Supply. Together, the aluminum pipe and couplers sold through the Nationwide organization in Canada cost the user about 100% more than the equivalent black iron pipe. In the U.S., a large aluminum company offered aluminum industrial pipe and tube at prices below those charged in that country for iron pipe in the equivalent sizes.

One possibility that was under consideration by Alcan was to seek the Nationwide Supply Co. Ltd. either as sole distributor for the proposed Alcan aluminum pipe and tube or as a distributor along with the three regular Alcan distributors. It was pointed out that Nationwide Supply and its associated jobbers operated on much higher margins than did Alcan's regular distributors. There was no assurance that Nationwide Supply would want to carry Alcan's new product and at the same time abide by Alcan's established sales policies. However, knowing that Nationwide Supply had sold over 200,000 pounds of industrial aluminum tubing in Canada during 1956, Alcan officials felt that it would make Alcan's job of marketing the new product much easier to have Nationwide Supply on their side.

The reports of the commercial research division had recommended that the company appoint as distributors any buyer who would purchase reasonable (not defined) quantities of aluminum industrial pipe. In discussing the purchasing habits and needs of buyers in each of the potential markets for aluminum industrial pipe and tube (i.e., petroleum, mining and construction), a report prepared for the sales department by the commercial research division stated:

> ". . . The channels of distribution are noticeably different for the various potential markets and it would seem wiser to aim at jobbers or distributors serving their own market rather than one distributor serving all. To make a success of this product it must be readily available and not require great effort to purchase or install. We feel strongly that a distribution network is needed which will bring the pipe as easily within reach of the customer as steel pipe is today . . ."

Part 3

The Aluminum Company of Canada Limited began the production and sale of aluminum industrial pipe and tube in May, 1957. At the end of 1957 executives felt that the company had had only moderate success in marketing the new product. Thus, in December, 1957, sales department personnel were trying to evaluate the promotional strategy that had been used by the company during the first half-year of sales. They hoped to suggest changes that would greatly increase sales of aluminum pipe and tubing during 1958.

Alcan officials had decided initially to distribute the industrial pipe and tube through their three regular distributors: National Metals Ltd., Ryerson Metal Sales Ltd., and Jackson Ltd. After the initial introductory period, however, one further distributor, Northern Ontario Pipe Sales Ltd., was appointed. Northern Ontario Pipe Sales Ltd. was a relatively large distributor of pipe and tubing in northern and western Ontario. They operated 14 branches in the mining areas of Ontario and had very close contacts with the mining trade. Despite some strained feelings that the appointment of Northern Ontario Pipe Sales Ltd. had caused between Alcan and its regular distributors, company officials had been very satisfied with the extra business this new distributor had developed. Company officials did not intend to appoint additional distributors in the near future.

It was Alcan's general sales policy to adopt the combination of advertising and promotion that would best supplement the personal selling done by both company and distributor salesforces. The advertising undertaken in support of each product was based on an analysis of the amount of advertising and promotion needed to supplement personal selling. Company officials felt that in the case of a new product, such as industrial pipe and tube, the company should adopt a "general announcement type" campaign. And, as a result of the market research undertaken by the commercial research division, it was decided that the advertising and promotion should be aimed at the petroleum, mining, and construction industries. The market research had indicated that these industries were the largest potential users of aluminum pipe and tube.

The following information describes the steps taken by Alcan to advertise and promote industrial pipe and tube during 1957. The campaign was prepared by Alcan's own sales advertising division in conjunction with Cockfield Brown and Company Limited, the company's advertising agency. Exhibits 1 and 2 show the cost breakdown of the 1957 campaign. The campaign was used to back up the primary promotional effort undertaken by Alcan, that is the direct contact made by Alcan salesmen with potential customers in the mining and construction fields.

The first pipe and tube advertisement, published in May, 1957, was designed to announce that Alcan was selling industrial pipe and tube. A

Exibit 1 *Cost Breakdown of the Industrial Pipe and Tube Promotional Campaign**
May to December, 1957

	Approximate Cost
Trade Journals	$20,000
Direct Mail	2,000
Samples	1,000
Total	$23,000

*Does not include the costs of any Alcan personnel associated with the project.

Exhibit 2 *Alcan Industrial Pipe, Trade Journal Advertising May to December, 1957*

Publication	*Cost per Insertion*	*Number of Insertions*	*Total Cost*
Northern Miner	$210	5	$1,050
Oil in Canada	235	6	1,410
Oilweek (estimated)	225	12	2,700
Roads and Engineering Construction	244	6	1,464
Western Business and Industry	160	6	960
Western Miner and Oil Review	155	2	310
Totals		37	$7,894
Other (including general business magazines, *Financial Post,* and other weekly and daily newspapers)			12,000
Total			$19,894

caption invited interested pipe users to contact their regular pipe distributor, or an Alcan sales office, for further details.

In the fall of 1957, a second set of advertisements was inserted in trade papers. These advertisements showed drawings of aluminum industrial pipe in some applications and described its product characteristics. The names of Alcan's four distributors were displayed in this second group of two advertisements.

Expenditure on the trade journal advertising outlined above was in the order of $20,000. Subsequently, some 24 written inquiries and a number of telephone inquiries were received by the Montreal sales group. Inquiries directed to company sales offices elsewhere in Canada were handled locally, with no record of these inquiries being kept at head office.

As shown in Exhibit 1, the company undertook a direct mail campaign costing approximately $2,000. The names for the direct mail campaign were obtained from mailing lists supplied by the *Financial Post* and two trade journals serving the mining, petroleum exploration, and construction industries. Each addressee received a copy of "Industrial Pipe and Tubing" and a stamped, return-addressed card asking Alcan to supply the sender additional information about Alcan aluminum industrial pipe and tube. The company received 160 replies from the 14,000 circulars which had been mailed out. As before, replies directed to company sales offices elsewhere in Canada were handled locally.

One of Alcan's distributors, National Metals Ltd., also prepared a leaflet on aluminum industrial pipe and tube and mailed it to over 6,000 prospective users. They reported receiving 120 replies to their mailing.

The company also made available samples of aluminum industrial pipe. Each tube sample was six inches long, was distinctively labelled, and was grooved on one end for use with one of the couplings recommended by the company. These samples were sent to the sales offices of both Alcan and its four distributors for distribution to potential customers. One thousand of these samples were made available at a cost of approximately $1,000. Alcan also supplied the distributors with 5,000 copies of "Industrial Pipe and Tubing."

Alcan's sales advertising department wrote several articles describing the advantages and characteristics of aluminum industrial pipe. Copies of these articles were sent to the editors of 53 trade journals throughout Canada. It was hoped that some of this material would find its way into editorial content of the respective publications.

One way to increase the sales of a plastic raw material is to influence those people who fabricate it, as opposed to those who are its ultimate consumers. This is the approach which has been followed by Eastman Chemical in marketing its Tenite thermoplastics (polyethylene, cellulose acetate and cellulose acetate butyrate).

In pursuing this approach, Eastman Chemical has made heavy use of a variety of print media—newspapers, general business magazines, trade journals, etc. However, these media have been carefully selected for their ability to reach the management level which is responsible for making decisions about the use of plastics in their firm's products.

The following case outlines Eastman's thermoplastics advertising program from its inception in 1934. This program has so far been successful both in generating sales and in uncovering new applications for Eastman's products.

36 Eastman Chemical Products, Inc.

by Gerald A. Simon and Martin V. Marshall

Questions to Consider: (1) What selling jobs has Eastman Chemical attempted to undertake since 1934? (2) The company employed advertising primarily for the purpose of stimulating primary demand. Was this a sound strategy? (3) What selling jobs face the company in the future, after 1956? (4) As a member of Eastman Chemical's management, would you approve Mr. Guthrie's proposed advertising program for 1957, or would you suggest changes? If so, what changes?

In the latter part of 1956, Mr. Dennis C. Guthrie, advertising manager for plastics for Eastman Chemical Products, Inc., was in the process of determining the 1957 advertising program for the company's various plastic materials. "Tenite Acetate," "Tenite Butyrate," and "Tenite Polyethylene."

Reprinted with permission from: Neil H. Borden and Martin V. Marshall, *Advertising Management: Text and Cases*, Revised Edition (Homewood, Illinois: Richard D. Irwin, Inc., 1959), pp. 301–312.

Company Background

Eastman Chemical Products, Inc., was the wholly owned subsidiary of Eastman Kodak Company, being responsible for the marketing of all products manufactured by two divisions of Eastman Kodak Company, Tennessee Eastman Company and Texas Eastman Company. Tennessee Eastman was established in 1920 for the purpose of making wood alcohol, a solvent then used in the manufacture of nitrocellulose film base, but which is now obsolete. In the late 1920's the production of cellulose acetate was transferred from the Eastman Kodak plant at Rochester to the Tennessee Eastman plant at Kingsport, Tennessee. Cellulose acetate was used in making the base for safety film as well as acetate yarn which the company began to produce in 1931 and the cellulose plastic, Tenite Acetate, in 1932. This was followed in 1938 by the production of Tenite Butyrate, another cellulose plastic made from cellulose acetate butyrate. In 1950 Texas Eastman Company was organized to produce, from propane and natural gas, chemicals such as butyraldehyde and ethyl alcohol used in the production of cellulose esters. In 1954 Texas Eastman began production of Tenite Polyethylene. Thus, in 1956 Eastman Chemical Products, Inc., was selling cellulose acetate fibers, industrial chemicals, and three plastics—namely, Tenite Acetate, Tenite Butyrate, and Tenite Polyethylene.

Industry Background

Plastics were discovered in 1869, but it was not until the end of World War I that anyone in the United States did any substantial work with these materials. Subsequent growth was rapid, however; in the 1920's and 1930's the industry approximately doubled in size every three to five years. By the mid-1940's the plastics industry was the fastest-growing industry in the United States. The end of World War II marked the beginning of extensive plant expansion, aggressive promotion, and increased competition in the industry, particularly as companies in the rubber and petroleum industries entered into the production of synthetic plastics materials.

The growth of the market for plastics was characterized historically by plastics fabricators (1) being able to substitute plastics for other materials in existing products, and (2) being able to develop new products which could be made only with plastics. Although special characteristics of certain ones of the many different kinds of plastics fitted them to some uses better than others, any one of several different types often could be used for the same purpose; therefore, they all more or less competed for the same markets. Consequently, price was a very important factor in the marketing of plastics, and a substantial differential in cost was often enough to convince certain manufacturers to select one type of plastic in preference to another.

The expansion of demand for polystyrene, a synthetic plastic which was competitively priced with cellulose plastics, illustrated the interchangeability of one plastic material for another. Production of polystyrene had expanded about ten times faster than production of cellulose plastics between 1946 and 1955. In 1955 production of polystyrene exceeded production of cellulose plastics—515 million pounds as compared to 145 million pounds, which was about 3% of the total production of all plastics.

In late 1956 the cheapest of the plastics was the thermosetting plastics, such as "Bakelite," which sold at about 20 cents a pound.[1] The thermoplastics, characterized by the polystyrenes, such as "Styron" and "Lustrex," sold at 30 to 40 cents a pound; the cellulosics, such as Tenite Acetate and Tenite Butyrate, at 38 to 50 cents a pound; the polyethylene plastics, such as Tenite Polyethylene, at 39 to 50 cents a pound; the acrylic plastics, such as "Lucite" and "Plexiglas," at 55 cents a pound; and the polyamide plastics, such as "Nylon," at $1.35 a pound.

As has been stated, there were many special characteristics among the different kinds of plastics materials. Although it is not worthwhile here to list all of the special characteristics of each type of plastic material, it should be pointed out that the cellulose plastics, such as those which were sold by Eastman Chemical, were adaptable to many different uses.

The salient characteristics of cellulose plastics were toughness, high impact strength, uniform texture, permanent luster, pleasant-to-touch surface, dielectric strength, lightweight, and an unlimited range of transparent, translucent, and variegated colors. Furthermore, cellulose plastics had a high degree of dimensional stability and could be molded and extruded to close tolerances. They could be punched, stamped, drilled, riveted, crimped, and sewed. These characteristics of cellulose plastics were somewhat different than the characteristics of other plastics, such as polystyrene. As a result, polystyrene had limited the growth of cellulose plastics but had not replaced them. Specifically, polystyrene was more brittle than Tenite Acetate; however, it was also more rigid and dimensionally stable.

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[1] The prices of plastics are best compared by taking into consideration specific gravity and the resultant price per unit of bulk. The prices given here are based on the weight of a unit bulk equal to a pound of cellulose acetate plastic.

The polyethylene plastics were also available in a wide variety of formulations suitable for numerous applications. The molded polyethylene plastics could be made flexible or semirigid. They were chemically inert and resistant to breakage, acid, high voltage, and moisture vapor transmission.

The processing characteristics of polyethylene plastics made them suitable for numerous applications. Since they were priced competitively with a number of other plastics, such as the cellulose acetates and polystyrene, the sales of polyethylene plastics had increased substantially in the period 1953–56: from 137 million pounds to 507 million pounds. Industry executives predicted sales of one billion pounds in 1960.

Before World War II, there had been only two producers of polyethylene plastics; in 1954 Texas Eastman became the third producer. By 1956 a dozen firms were producing polyethylene plastics.

The Market for Plastics

The principal customers of the manufacturers of plastics materials were approximately 750 molders and extruders who were classified as "custom" or "proprietary." The custom firms extruded or molded plastics for approximately 2,000 fabricators, who in turn tooled the plastics or combined them with other materials to make fabricated parts primarily for the electrical radio-television, airplane, household equipment, packaging, architectural, building, and novelty industries. Often, custom molders and extruders maintained sales forces and advertising programs to promote new business and, therefore, were consulted by the users of fabricated parts, thereby affecting the type of plastic ultimately used by a fabricator in manufacturing a particular fabricated part.

There were two types of proprietary molders and extruders: the first type completed the manufacture of consumer products and sold them to retailers; the second type, the so-called "captive shops," were essentially manufacturers of fabricated parts for their own use; for instance, automobile companies which maintained fabricating departments to make automobile interior appointments or telephone manufacturers which molded their own telephone bases and handsets.

The molding and extruding phase of the industry was extremely competitive because it took only a modest capital investment for anyone to enter the business, and price usually was the newcomer's chief competitive tool. Hence, it was not at all unusual for a custom molder or extruder to develop a new application or a new account after much work and then lose it to a competitor.

Applications for Tenite Plastics

Typical uses of Tenite cellulose plastics were as rollers for lawn mowers, chessmen, both black and colored telephones, shoe heels, handles for tools, oil field and industrial pipe, steering wheels, toys, appliance housings and parts, sunglass frames, gunstocks, football helmets, outdoor signs, fishing line, and other sporting goods. A significant new application—women's shoe heels—had been discovered for acetate and butyrate in late 1955. By the end of 1956 industry consumption of acetate and butyrate for heels was at an estimated 500,000 pounds per month; without this new application, 1956 industry sales of cellulose acetates would have been less than that for 1955. About the same or a slightly higher level of consumption of acetate and butyrate for women's shoe heels was anticipated in 1957. Other comparatively recent applications of butyrate (which was tougher than acetate) were in electrical conduit for use by utilities, in pipe for transmitting natural gas and sour crude oil, and in salt water disposal.

Tenite Polyethylene had been found to be particularly suitable for use in the familiar squeeze bottles for cosmetics and foods, as extruded film for packaging, for molded household items, for extruded pipe in irrigation and other water-piping uses, and as coatings for electrical wire and cable, as indicated in the following industry sales figures for 1956:

	Per Cent of Total Sales (507 Million Pounds)
Film and sheeting	29.6%
Bottles, jars, and tubes	2.4
Molding (general)	14.8
Wire and cable insulation	11.8
Pipe	5.9
Coatings	6.9
Exports	27.6
Miscellaneous	1.0
Total	100.0%

Eastman Chemical executives believed that Tenite Polyethylene enjoyed an advantage over competitive polyethylene materials in that it was supplied in the form of spherical pellets rather than the usual odd-shaped pieces, which speeded up the flow of materials, reduced storage space, and helped to keep molding compounds dirt-free. These features were advertised from time to time, along with Eastman Chemical's "complete color service" for polyethylene formulations.

Although various properties made Tenite Acetate, Tenite Butyrate, and Tenite Polyethylene suitable for different applications, generally speaking, each of the plastics marketed by Eastman Chemical competed with other producers' plastic materials for the same or similar uses.

Eastman Chemical's Marketing Objectives

Eastman Chemical had four marketing objectives for plastic: (1) to develop end-markets for specific applications of plastics materials through stimulation of trade and consumer demand; (2) to stimulate trade and consumer demand for plastic materials, regardless of specific application; (3) to provide service and counsel to molders, extruders, and fabricators, which would help them overcome their design, production, and promotional problems; and (4) to make available to molders and extruders a wide variety of formulations, many specifically developed to meet customer requirements.

Tenite Marketing Program

Eastman Chemical sought to accomplish these sales objectives by a four-part marketing program, as follows:

1. Constant research to produce new formulations and experiment with new applications.
2. Regular publicity to the trade press of new and interesting developments.
3. Trade advertising and promotion to encourage new applications for Tenite plastics, to gain greater acceptance for existing applications, and to generate leads for the sales force.
4. Sales and service by experienced, technically trained men strategically located in Eastman Chemical branch offices throughout the United States.

The Company's Sales Force

Eastman Chemical's sales force was typical of the sales forces of the leading companies in the industry. The company maintained a staff of from one to four men in each of its sixteen regional offices: Atlanta, Chicago, Cleveland, Dayton, Detroit, Houston, Kansas City, Leominster (Mass.), Los Angeles, New York, Portland (Oregon), Rochester, St. Louis, San Francisco, Seattle, and Toronto. These men were technical salesmen and service men, generally with mechanical or chemical engineering backgrounds; all had been trained in the company's technical departments.

The Tenite representatives made frequent calls on all molders and extruders in the country. They also followed up inquiries produced by Tenite advertising; these inquiries were from molders and extruders, in addition to potential fabricators. When possible, Tenite representatives referred these fabricators to the molders and extruders who, they believed, could best handle the job. On inquiries which Tenite representatives believed held a large potential for Tenite plastics, they would frequently work in the potential fabricator's laboratory along with that company's research staff. If necessary, a manufacturer's problem would be taken to the Tenite laboratory in Kingsport, Tennessee.

Because Tenite representatives frequently discovered new customers for new and existing applications as a result of inquiries produced by Tenite advertising, advertising played a significant part in the promotional program for Tenite plastics.

The Promotion of Tenite Plastics, 1934–54

When the executives of Tennessee Eastman Corporation first marketed Tenite Acetate in 1932, they based their marketing strategy on the premise that the principal objective of the corporation's sales promotional efforts should be to develop new markets for plastics materials rather than to compete for a large share of the then small existing market. Although Tenite's sales representatives during the 1930's made frequent calls on molders, they were primarily interested in working with fabricators or manufacturers who had indicated an interest in the potential uses of plastics. Although Tenite's initial advertisements were placed in media which covered molders and fabricators, the advertisements were directed primarily to the top executives of manufacturing companies—top executives who would have to make the major policy decision to substitute plastics for a well-established material in an existing product or to enter a new product field through the use of plastics.

Eastman's first plastics advertising in 1934 and 1935 was placed in *Modern Plastics* and *Product Engineering,* on the basis that top executives who were becoming interested in the use of plastics would turn to those publications for information. In 1936 the company dropped *Product*

Engineering and entered into other plastic trade papers, including—over the next ten years—the following: *Industrial Plastics, Plastics, Plastics and Resins, Plastics Buyer, Plastics World,* and *Pacific Plastics.* One of the primary reasons for the use of all of these trade papers was to lend advertising support to worthy trade publications in the plastics field; these publications carried product news which Tennessee Eastman executives believed frequently awakened more trade interest than the same information would if it were to appear in paid advertising space. The company systematically tried to capitalize on this fact by maintaining its own photographic studio in which it photographed every new application of Tenite. These pictures and the facts about each picture were subsequently released to all trade publications in the plastics field. The editorial mentions which Tenite received annually greatly exceeded the circulation attained through its paid advertising.

The theme of the advertisements used in trade papers was the same in all cases. The advertisements consisted of a photograph of a product made of Tenite and copy explaining the properties of the plastic that fitted it for such a use and similar uses. An offer to supply additional information upon request was included.

In 1938 Tennessee Eastman is said to have been the first plastics producer to advertise in *Fortune.* Full-color, photographically illustrated pages were used on a quarterly or five-times-a-year schedule, with "reason-why" copy similar to that of Tenite advertisements running in the plastics industry papers. In 1941–42 *Time* and *Business Week* were added to the advertising schedule. These three publications were used as horizontal media to reach business executives in all industries, whether or not they used plastics. The management believed that at that time potential users of Tenite were not concentrated enough in particular industries for the company to rely on selected vertical media,[2] that is, the cost of reaching individuals in the hundreds of industries which used plastics seemed prohibitive.

For a brief period in 1940–41, insertions in Sunday supplements were employed in newspapers in New York, Chicago, Detroit, Cleveland, and Boston. Although inquiries came from product manufacturers in many hitherto unexplored fields as a result of these advertisements, the newspaper schedule was discontinued with the advent of World War II, as was advertising in all but the trade papers of the plastics industry. Tenite and its ingredients had become allocated to essential wartime uses.

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[2] Vertical media are those which deal with the interests of a particular industry and which accordingly are subscribed to by companies or individuals within a particular industry, that is, *Textile World Magazine, Paper Mill News, Railway Age.* Horizontal media make their appeal to the interests of functional groups and are subscribed to by the companies or industries in numerous industries, that is, *Factory Management and Maintenance, Purchasing,* and *Sales Management.*

In 1947 Tennessee Eastman instituted a newspaper advertising campaign in the 12 cities in which it then had sales offices; these advertisements, which appeared once a week on the financial page of 19 newspapers, were 630 lines in size and were of the same type as those which continued to run in the trade magazines of the plastics industry. The main difference between advertisements in the two media was that the newspaper advertisements listed the name, address, and telephone number of the local Tenite representative.

Newspapers were used because they provided a quick and effective, although expensive, method of reaching businessmen. Toward the end of 1948, when company executives thought that they had accomplished their objective in newspapers, they discontinued their use except for the *New York Times*. Throughout the postwar years, including 1956, the business section of the *New York Times* carried regular scheduled Tenite advertisements, consisting of 24, 630-line insertions a year. The *New York Times* was regarded by Mr. Guthrie as a "national medium" since it developed inquiries from all sections of the United States. These advertisements listed Eastman Chemical's 16 sales offices instead of individual Tenite representatives. Photographically illustrated advertisements, such as those run by the company, were unusual for the business section and, Mr. Guthrie believed, achieved high readership.

In the years 1948–54 the company spent about $100,000 a year for advertising space in plastics trade journals and the *New York Times*. Not until late 1954, when Tenite Polyethylene was introduced, did the company regularly use media other than plastic trade journals.

Tenite Promotional Program after Introduction of Tenite Polyethylene in 1954

In 1954, with the availability of Tenite Polyethylene, Mr. Guthrie recommended the use of additional business publications. He wished to capitalize on the fact that a new supplier was entering the market for the first time in ten years. He also wanted to establish quickly the Tenite name in polyethylene since he knew that several other companies planned to produce polyethylene within the next two years.

As a first step, in late 1954 a schedule of advertisements was begun in *Newsweek, Business Week, Scientific American* (to reach technical management), and the *Wall Street Journal*. Each advertisement in these magazines featured an illustration of a successful application of Tenite Polyethylene, Tenite Acetate, or Tenite Butyrate; Tenite Polyethylene applications were shown most frequently. At the bottom of each advertisement all three Tenite plastics were listed, with the phrase "plastics by Eastman."

In 1955 Mr. Guthrie established two objectives for Tenite Polyethylene advertising: (1) to find as many new applications as possible, and (2) to publicize these applications as rapidly as possible.

Because of the growing interest by molders in applications of polyethylene for housewares, Mr. Guthrie recommended in 1955 a "saturation" schedule in publications reaching manufacturers and trade buyers of housewares products: *Housewares Review, Hardware Age,* and *Chain Store Age.* This saturation campaign, consisting of two- or three-full pages and double spreads in full color each issue, lasted four months. Afterwards, the campaign in housewares publications continued but at a more moderate rate. The company's expenditure for advertising space in 1955 was about $150,000.

Tenite sales representatives reported that molders whose housewares products were featured in Tenite advertisements were particularly pleased; these molders believed that the advertisments were read by trade buyers. Polyethylene achieved rapid acceptance in housewares in 1955; typical applications were dish pans, tumblers, laundry baskets, and waste baskets, usually in bright colors.

In 1956 Mr. Guthrie expanded the Tenite advertising program to include additional industries served by molders and extruders of Tenite plastics, as shown in Exhibit 1, spending about $234,000.

In addition to advertising in publications, Tenite promotional activities in late 1956 included: periodic direct mailings to about 5,000 direct and indirect users of Tenite; publicity releases to the trade press; exhibits at trade shows; and Tenite tags and labels for use by fabricators. Two motion pictures were available for free showings to interested groups; one film, "Story of Tenite," was aimed at any potential customer for Tenite, while another, "Plastic Pipelines," was designed to interest executives in the natural gas and petroleum industries in the use of Tenite Butyrate pipe.

Tenite Advertising Plans for 1957

In late 1956 Mr. Guthrie was considering a proposal for the 1957 advertising program for Tenite. The advertising budget was to be increased from $234,000—the 1956 expenditure—to about $310,000. Increased emphasis was to be given to new applications of Tenite plastics, particularly of Tenite Polyethylene and Tenite Butyrate. Specifically, polyethyl-

Exhibit 1 Eastman Chemical Products, Inc., Media Schedules, 1956 and 1957 (Proposed)

			1956		1957 (Proposed)	
	Circulation (Nearest 1,000)	Products Featured	Insertions	Total Space Cost	Insertions	Total Space Cost
Agriculture:						
Better Farming Methods	30,000	Polyethylene pipe	1	$ 570	6	$ 3,420
County Agent and Vo-Ag Teacher	30,000	" "	1	616	6	3,696
Farm Implement News	24,000	" "			6	2,100
Farm Journal	3,624,000	" "			4	47,800
Implement and Tractor	24,000	" "			6	2,220
Western Farm Equipment	6,000	" "			3	1,944
				$ 1,186		$ 61,180
Design:						
Industrial Design	9,000	All	6	$ 3,765	6	$ 4,666
Materials and Methods	30,000	"	6	4,122	6	4,122
				$ 7,887		$ 8,788
Electrical:						
Electrical Engineering		Polyethylene and butyrate housings	6	$ 3,888		
Electrical Manufacturing	23,000		6	3,924	6	$ 4,416
				$ 7,812		$ 4,416
Executive:						
Business Week	283,000	All	10	$ 38,778	10	$ 40,933
Journal of Commerce	39,000	"			254	3,543
Newsweek	1,063,000	"	10	75,296	10	72,358
New York Times	571,000	"	10	11,640	10	11,040
Scientific American	151,000	"	10	22,298	10	25,714
Wall Street Journal	395,000	"	10	14,520	10	16,200
				$162,532		$169,788

Exhibit 1 (continued)

	Circulation (Nearest 1,000)	Products Featured	1956		1957 (Proposed)	
			Insertions	Total Space Cost	Insertions	Total Space Cost
Gas and Oil:						
Gas	10,000	Butyrate pipe	6	$ 2,460	6	$ 2,610
Gas Age	7,000	" "	6	2,490	6	2,490
Oil and Gas Journal	35,000	" "	6	3,030	6	3,570
				$ 7,980		$ 8,670
Housewares:						
Chain Store Age		Polyethylene	6	$ 4,656		
Hardware Age	38,000	" pipe	6	3,390	6	$ 3,180
Housewares Review		"	6	3,342		
				$ 11,388		$ 3,180
Packaging:						
Modern Packaging	22,000	All	6	$ 3,120	6	$ 3,420
Packaging Parade	21,000	"	6	3,308	6	3,507
Paper, Film and Foil Converter	6,000	"	6	1,770	6	2,303
				$ 8,198		$ 9,230
Plastics:						
Canadian Plastics	5,000	All	12	$ 2,436	12	$ 2,940
Modern Plastics	26,000	"	12	6,900	12	7,980
Modern Plastics Encyclopedia	26,000	"	1	630	2	1,340
Plastics Technology	11,000	"			6	3,030
Plastics World	32,000	"	12	9,000	12	8,700
SPE Journal	5,000	"			6	1,800
Western Plastics	5,000	"			6	2,280
				$ 18,966		$ 28,070

Exhibit 1 (continued)

	Circulation (Nearest 1,000)	Products Featured	1956		1957 (Proposed)	
			Insertions	Total Space Cost	Insertions	Total Space Cost
Plumbing:						
Plumbing and Heating Business	28,000	Polyethylene pipe			6	$ 3,504
Shoe:						
American Shoemaking	4,000	Acetate and Butyrate Women's heels			6	$ 1,002
Footwear News	18,000	" "			12	1,560
Leather and Shoes	5,000	" "			6	1,344
						$ 3,906
Sign:						
Screen Process	8,000	Butyrate			6	$ 1,761
Signs of the Times	15,000	"	6	$ 1,899	6	2,067
						$ 3,828
Utilities:						
Electrical World	26,000	Polyethylene and Butyrate insulation and pipe	6	$ 4,260	6	$ 4,260
Telephony	11,000		6	1,361	6	1,474
				$ 5,621		$ 5,734
Miscellaneous:						
Thomas' Register	24,000	All	1	$ 380	1	$ 500
				$233,849		$310,794

Note: Costs per insertion are not necessarily comparable due to variations in size of insertions.

ene, which had become well established in housewares, was now to be emphasized for agricultural pipe; therefore, two of the three housewares publications would be dropped and about $61,000 would be spent in agricultural media. (Polyethylene pipe was sold by all farm supply houses and was gaining rapid acceptance by farmers for carrying water; polyethylene pipe was easy to install, light in weight, and expanded when frozen.)

About $4,000 was to be spent in three publications serving the shoe industry; the company had never before advertised to this industry.

In considering the Tenite advertising program for 1957, Mr. Guthrie knew that Eastman Chemical's management would accept his recommendation, provided that the program performed two major functions: (1) if it helped the company to learn about new and unknown markets and applications of Tenite through production of inquiries; and (2) if it helped Tenite salesmen to close sales. In general, although formal means of evaluating advertising effectiveness were not available to him, Mr. Guthrie believed that previous Tenite advertising had been successful in achieving these objectives.

This case provides an example of several CPI firms selling products that are chemically identical. Du Pont, Merck, Pfizer and Abbott all produce cyclamate, a noncaloric sweetener. On what basis, then, can these firms compete? Price competition, for example, would be ruinous to all, and the product does not lend itself to packaging differentiation.

Abbott Laboratories chose to try to develop consumer demand both for its brand of cyclamate (Sucaryl) and for products sweetened with Sucaryl. Thus, if Abbott were successful, the bulk purchasers, who took most of Abbott's cyclamate, would be forced to continue their Sucaryl purchases by the consumer demand.

This case presents the background information about Abbott's cyclamate business, and outlines Abbott's proposed marketing program for this sweetener.

37 Abbott Laboratories

by Ralph Westfall and Harper W. Boyd, Jr.

In 1950 Abbott Laboratories, one of the leading United States manufacturers of drug products, culminated ten years of research and testing of cyclamate, a new chemical compound, for use as a noncaloric sweetener. The product was given the trade name Sucaryl and was the first new noncaloric sweetener to be developed since the early 1900's, when saccharin was first introduced. Sucaryl was introduced to two markets simultaneously—in a packaged form for consumers and in bulk to dietetic food and drink processors. The packaged Sucaryl was marketed through Abbott's distribution organization to drugstores only. The chemical sales division was given responsibility for bulk sales direct to food and beverage processors.

During the period 1950–55, the chemical sales division did some advertising through trade journals, but in accordance with company policy

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there was no consumer advertising of Sucaryl except for point-of-sale and window displays for packaged Sucaryl sold through drugstores. Abbott manufactured and marketed Sucaryl under a license from Du Pont, which held the patent on cyclamate. It was not an exclusive license, and by 1955 other chemical companies had started to enter the market with bulk cyclamate. The company then faced the problem of establishing the brand name of Sucaryl firmly in the market to hold off competition.

Abbott Laboratories maintained plants in seventeen foreign countries and sales offices in almost every country in the world. Net sales in 1958 were in excess of $116 million. Abbott distributed its pharmaceutical products primarily through its own marketing organization. Warehouses were located in twenty-one strategic spots throughout the country to assure quick delivery. Historically, company policy had been not to advertise to consumers. Promotion was done primarily through detail men who contacted doctors and druggists to inform them of new products or further uses of other products. In addition, direct mail and trade journals were used to reach doctors, hospitals, and druggists, and point-of-sale displays were given to druggists for products that could be sold without prescription, such as vitamins or Sucaryl.

By 1955 Abbott had two competitors in the bulk market in addition to Du Pont. None of these competitors had put any emphasis on the consumer market for noncaloric sweeteners. At this time Abbott did 75 per cent of the bulk cyclamate business, Pfizer had about 15 per cent of the market, Du Pont about 8 per cent, and Merck about 2 per cent. The company realized that, as competition increased, the main factors in controlling market share would be the reputation of the company and the establishment of the trade name in the consumers' minds. There was no difference in the chemical compound cyclamate. The company directors therefore decided to make Sucaryl an exception to the advertising policy of the company and to begin a consumer promotion campaign to establish firmly the Sucaryl trademark.

Up to the introduction of Sucaryl, saccharin had been the only noncaloric sweetener approved by the federal Food and Drug Administration. Saccharin had not been used widely by dietetic food and beverage processors because it often left a metallic aftertaste in the consumer's mouth. But saccharin was the only noncaloric sweetener available for diabetics and other people who could not use sugar, Abbott's tests showed cyclamate to be stable in all food and beverage processing, and taste tests indicated its aftertaste incidence to be much lower than saccharin's. There were other dietetic foods on the market that utilized the natural sweetness of fruits or other foods or that contained no sweeteners at all.

Many problems arose in the first stages of marketing Sucaryl to food and drink processors. Although the product had been approved by the federal Food and Drug Administration, many states had laws against using such additives in processed foods. So, state by state, Abbott had to prove its case for Sucaryl. By 1952 all but nine states approved Sucaryl for use in processed foods and drinks, and by 1955 the toughest of these had been won over. The second problem was price. In 1950 saccharin was selling for $1.80 per pound and had a sweetening power 440 times that of sugar. Sucaryl, on the other hand, was sold at $3.50 per pound, and its sweetening power was only 30 times that of sugar. As a result, Sucaryl cost users about 26 times as much as saccharin per pound of sweetener. By 1955, volume production brought the price down to $2.95 per pound, which, as a sweetening agent, about equalled the cost of sugar. In 1958 the price was reduced to $1.95 per pound.

The chemical sales division undertook the responsibility for merchandising the Sucaryl trademark. It was primarily concerned with protecting its bulk market from competition. The promotion program for packaged Sucaryl for consumers was administered independently of the bulk program. The chemical sales division was only a three-man division in 1950, and it handled all sales of chemicals and drugs to industrial users. By 1955 the organization had expanded to include a general manager, a sales manager, an assistant sales manager, and five salesmen. Much of this expansion was due to the increasing sales of bulk Sucaryl, which had reached 379,000 pounds in 1955 and 575,000 pounds in 1958.

The program developed for merchandising the Sucaryl trademark was based on the fact that the people who used noncaloric sweeteners at home were also customers for processed foods and drinks that used a noncaloric sweetener. The market for noncaloric sweeteners included diabetics and overweight and other diet-conscious people. A market study done by Abbott in 1956 revealed that one out of every three Americans was either overweight or concerned about his weight. Sales of dietetic canned fruits had risen from 100,000 cases in 1950 to over 3 million cases in 1956, and sales of dietetic soft drinks had risen from 1 million cases a year in 1950 to over 15 million cases in 1956. A study of supermarket sales reported that dietetic foods represent 1.5 per cent of total store sales. These studies of the dietetic food market included low sodium and "natural" foods as well as sugar-free foods.

The proposed program was to advertise the Sucaryl trademark to consumers. The ads would be designed to get consumers to buy dietetic foods that were sweetened with Sucaryl and would emphasize that foods or beverages sweetened with Sucaryl would carry the Sucaryl trademark on their labels. The company offered the trademark to all customers to use on their labels. Some customers were already using the name Sucaryl or the trademark on their labels in 1955. The company thought that such action would help pre-sell customers' products. It was hoped that this program would develop strong consumer demand for products sweetened with Sucaryl and, thereby, make it difficult for a competitor to draw away Abbott's bulk customers, since none of the competitors' sweeteners were known in the consumer market. In conjunction with the consumer ads, Abbott would run ads in trade journals that reached food and soft drink processors, showing the current consumer ads and citing the benefits of these to Abbott customers.

The campaign for packaged Sucaryl started in 1955 but the trademark program did not get into full swing until 1958, although two consumer ads were run in 1957. The 1958 program called for five three-quarter page ads to run in the *Saturday Evening Post.* These would aim at selling dietetic foods and drinks sweetened with Sucaryl. In the same months, ads would be run in the trade magazines. The 1958 campaign for packaged Sucaryl called for ads in the *Saturday Evening Post, Time, Readers' Digest, Ladies' Home Journal,* and several other leading magazines. The advertising budgets were as shown in the accompanying tabulation.

Year	Packaged	Bulk
1955	$ 804,000	$ 71,000
1956	1,194,000	58,000
1957	1,497,000	200,000
1958	1,350,000	259,000

Should Abbott's proposed promotion program be adopted?

Chemical process industry firms are among the nation's biggest advertisers. In 1960, for example, it is estimated that the CPI spent more than half a billion dollars on advertising in all media. Where does the money go; is it worthwhile; what is the purpose of these enormous expenditures? These and other questions arise very often. It is the purpose of the following three selections to illustrate some advertising policies and behavior in the CPI.

The objectives of the advertising policies illustrated vary considerably. Reichhold Chemicals, for example, has used advertising to create an awareness among potential customers that it was able to supply market needs in several fields. This approach to advertising is particularly important for a firm that is entering new fields and changing its capabilities at a fast pace. Eastman Chemical has used advertising to introduce new products, build its corporate image, promote existing products, and so on. Pfaudler follows still another approach.

38 Where Ads Must Blaze the Market

from Printers' Ink

The guest on Garry Moore's "I've Got a Secret" show carried a tiny applicator bottle. On the table in front of him lay something resembling a T-bar ski lift attached to a piece of steel cable. Another steel cable dangled from an overhead winch. At a cue, the guest pasted the two cables together with a drop from his applicator bottle; the winch whined; Moore grasped the T-bar and soared up and away.

The magical link between Moore and the heavens was Eastman 910 Adhesive—an accidental discovery of Eastman Kodak's chemical research labs at Kingsport, Tenn. One drop of it is strong enough to paste your car to the ceiling.

Eastman 910 Adhesive is much more spectacular than most of the new products that flow out of Eastman Chemical labs, all of which are marketed through Eastman's sales subsidiary, Eastman Chemical Products, Inc. (ECPI). But this puts it in a better position to illustrate an important

Reprinted with permission from *Printers' Ink,* Vol. 271, No. 13 (June 24, 1960), pp. 48, 50.

fact about the chemical industry: Marketing changes take place so fast and unexpectedly that advertising men are hard put to keep up with them.

A few years ago, for example, telephones represented the single largest market for Eastman's Tenite plastics (Tenite is a brand name for all Eastman's plastics). Today, other plastics are moving into this market. Meanwhile, Eastman plastics are moving into the markets for lighted outdoor signs and automobile steering wheels.

Although, about 25 large chemical companies are developing new products as fast as they can.

New plastics, chemicals and fibers are continually replacing one another in existing markets, as well as constantly searching for new markets. Eastman itself turns out new products at a rate of about two a month.

The merry-go-round has this effect on ECPI's industrial advertising: Ad campaigns must search out markets as well as sell products. Incidentally, ECPI markets only basic materials—plastic pellets, bulk chemicals and man-made fibers; it doesn't go into secondary manufacturing processes such as extrusion or weaving.

Thus, the company has to advertise both to end-product manufacturers and to its direct customers—the extruders, formulators and textile mills. (In the case of textiles, it also runs consumer ads.) Advertising programs are separate for the three divisions—plastics, chemicals and fibers—and each has its own advertising manager: Dennis C. Guthrie, Robert R. Moore and Bruce Roberts, respectively. Fred Wittner Co., New York, prepares plastics and chemicals advertising; fibers are handled by Doherty, Clifford, Steers & Shenfield, also of New York.

In ECPI's marketing strategy, publicity often serves to discover and pinpoint markets. A case in point is ECPI's cellulose acetate butyrate, a unique film-former for lacquers. Lacquers properly made with cellulose acetate butyrate don't darken with age as other lacquers do. A ready-made sales campaign? Yet consider these complications:

1. Lacquer-makers have been marketing nitrocellulose lacquers profitably for decades. They know their limitations, accept them philosophically, and are reluctant to rock the boat.
2. When cellulose acetate butyrate was developed, lacquer-markers didn't even know how to formulate a lacquer using it. They had to develop their own new formulas (ECPI could offer only its experimental formulas to serve as starting points for further developments).

sales message for lacquer-makers is lower cost. And
ıtyrate is expensive.

ıad to do," says Robert Moore, advertising director
division, "was to convince lacquer manufacturers

that acetate butyrate would make their product more salable. In other words, we had to create a demand for a lacquer that had never yet even been commercially formulated."

ECPI tested the new film-former for 18 months on aluminum truck trailers; it preserved the bright shine of the original metal through all kinds of weather. ECPI marketing strategists decided to advertise it first as an aluminum coating, use this as a wedge into the much larger light-finished furniture market.

In 1958, ECPI opened a campaign of full-page ads in Architectural Record and Modern Metals, aimed at the construction and metalworking industries respectively. Running 12 times a year, these ads cited specific buildings which used "Half-Second Butyrate" lacquers.

Simultaneously, the furniture program got under way. In 1958, ECPI persuaded one lacquer-maker to formulate a butyrate lacquer for a furniture-maker who had asked for a non-yellowing finish. With the product actually in use, ECPI timed a news release to appear shortly before a large furniture show in Chicago. This persuaded several more manufacturers to use the new lacquer at the show.

Next, an ad campaign in Furniture World and Furniture South showed a couple who had just been sold on a major piece of furniture because of its non-yellowing finish. This approach was backed by an ECPI survey, which showed that furniture customers consider finish as important a factor as style and construction.

A year later—in 1959—the campaign was expanded to include furniture designers through Interior Design. Industrial Finishing and three papers for the paint and varnish industry were also added to the schedule at this time.

Starting out with one butyrate lacquer formulator in 1958, this strategy has brought the number up to 25 today. Now, ECPI is concentrating on persuading retail salesmen to use the butyrate lacquer finish as a sales point. It sends retailers brochures on the finish, offers furniture manufacturers decals at half-price to attach to butyrate-lacquered pieces.

Thus, in the chemicals division, an exploratory approach is used to solve the problem of rapidly shifting products and markets.

The plastics division uses a slightly different approach—an executive-level campaign of four-color ads, frequently in spreads. These are now running on a 14-page schedule in Newsweek, Business Week, Scientific American, and ten times a year in The New York Times and The Wall Street Journal (black and white in the last two, of course).

Definitely designed as stoppers, each one is focused on a colorful use of Tenite plastics. An ad early this year showed 20 different brightly-colored fish lures hanging in mid-air across the double spread. Others have shown Tenite steering wheels from nine different makes of cars, large Tenite Christmas decorations against a black background.

White space is used generously. "When used well, it gets maximum attention with no art or production costs at all," says Charles Kopf, ECPI account supervisor at Fred Wittner.

Main purpose of the ads is to stimulate new uses for Tenite plastics. They are aimed more at the man who has never used Tenite than the man who has. "They're designed to hit a cross-section of industry executives," says Dennis Guthrie, plastics division advertising manager at ECPI. "We couldn't possibly reach the top men in all the different industries that use or could use plastics any other way."

Copy in these ads is brief—usually three or four paragraphs—and general. "To sell a product once, make it attractive," reads the fish lure ad. "To sell a product over and over make it dependable. To make products that are both attractive and dependable, make them of tough Tenite plastic . . ."

New Theme: "Quality Control"

New products, such as ECPI's polyethylene bread wrap, are often featured in this campaign, which usually also runs in many of the approximately 30 business papers that ECPI uses to advertise its plastics.

Highlight is a single corporate ad that runs once a year. This year's theme, "quality control," is getting notable treatment:

1. The rather soporific term "quality control" is equated with the much more interesting term, "A company's conscience at work."
2. Headlines, copy and a small galaxy of 13 various-sized pictures form a dynamic balance.
3. Captions and large pictures are entirely omitted so that the layout doesn't compete with the copy message.

The ad drew accolades of praise. The quality control manager of a large competitor even offered his congratulations.

The entire series, which dates back to 1954, has high readership. The fish lure ad received one of the highest Starch ratings in Business Week. The corporate ad on color in plastics received a Reader Feedback score of 45 in Product Engineering.

Over-all, this is the type of flexible advertising that has helped ECPI build up sales of close to a quarter-billion dollars annually—about a quarter of Eastman Kodak's total annual sales. ECPI today is in the ranks of the largest chemical products manufacturers.

39 Establishing an Untried Product

from Printers' Ink

The mailing department at the Pfaudler division of Pfaudler Permutit Inc., Rochester, N.Y., was bustling this week. The company was answering requests for samples of "Nucerite"—a newly discovered family of ceramic-metal materials—from product engineers and research men throughout the nation.

Executives of this large producer of process equipment and materials for the chemical, food, petroleum and various other industries, expect to have a lengthy list of potential applications for Nucerite (*nu*cleated *cer*amic compos*ites*) before the year is out. If these expectations materialize, and it appears they will, the firm will reap the benefits of an advertising gamble it took last fall.

Pfaudler scientists discovered the Nucerite family of materials (metals coated with ceramics) during a search for heat- and corrosion-resistant products to be used in the company's line of process equipment (tanks, pipes, reactors, etc.).

The discovery, while creating interesting new opportunities, also raised a new marketing problem. Basil Dumbleton, manager of sales aid for Pfaudler, explained: "The material had terrific impact, corrosion and abrasion resistance, and it could take temperatures up to 1,500 degrees. We knew there would probably be many uses in chemical processing and other fields, such as space. But we didn't know what they might be."

Best Bet: Ads

Pfaudler management, though enthusiastic, realized that any attempt by the company itself to field-test Nucerite and pioneer product uses would be tremendously difficult and costly. Instead, they decided to gamble on an advertising program that would encourage other companies to test the new material.

Reprinted with permission from *Printers' Ink*, Vol. 276, No. 8 (August 25, 1961), pp. 34–35.

Dumbleton and Donald C. Deyle, advertising manager, began discussing the task with Thomas Howard, account executive from Rumrill Co., a growing Rochester agency with a flair for industrial accounts.

Two major questions pervaded the atmosphere of these initial meetings:

1. Would companies, in the midst of a recession, willingly invest money to test a new material?
2. Would engineers and designers feel that Nucerite was just another construction product in a seemingly endless product parade?

The three men concluded that despite the odds, a really forceful advertising program could put across Nucerite. Top company officials agreed.

The resulting advertisement was surprisingly simple but powerful. The illustration, designed by agency art director, Chad Hickey, was a colorful drawing. A red flame shooting out of a tube appeared to be subjecting a sheet of Nucerite to tortuous heat. Tom Howard commented: "When you show a scientist or product engineer a material undergoing tests or under strain, it really catches his attention."

Above the "test" picture were two lines: "This is 'Fluidics' in action—one aspect of Pfaudler Permutit's comprehensive program to help industry solve problems in handling of liquids and gases." (Pfaudler had coined the term Fluidics in some of its earlier advertising. Gradually this word, most often associated with the company, has come to be accepted by scientists and engineers as meaning the general science of fluids.)

Chemical Publications Chosen

Below the picture, bold copy commented on other virtues of Nucerite, which was printed in red. "Don't finance corrosion, forget it . . . with Nucerite." This copy, written by Nisson M. Lieberman of Rumrill, went on to discuss the product further, and noted in the conclusion, "Today, Nucerite is a laboratory achievement. You are invited to make inquiries on possible applications for it and investigate field testing programs."

The agency media department selected a representative group of chemical publications for the ads, primarily because Pfaudler engineers believed chemical process fields offered the most logical market for Nucerite. A similar version of the ad was prepared for several leading business and scientific publications. These would cover horizontal markets such as space or petroleum. The agency scheduled the ads for November and planned to continue the program in spring of this year.

For complete coordination, a small Rochester public relations firm, L. M. Harvey & Co., helped with supplemental material. With the agency it worked up demonstrations of the materials, technical bulletins and stories for leading trade magazines. Ad reprints were mailed to potential customers and to the Pfaudler company's district sales offices.

Results Overwhelming

"Believe it or not," Howard commented with a laugh, "we had to hold up on running the ads again as we had planned for this spring. If we hadn't, we would have run out of samples of Nucerite."

Results, according to Dumbleton, have surprised even top management. He reported that as of last Monday (August 21), Pfaudler's product department had received 2,500 inquiries, and they were still pouring in. The department has shipped 514 samples of Nucerite to more than 156 companies.

Scores of Ideas Already

The firms, many of which will undoubtably cooperate with Pfaudler in field-testing Nucerite, have already suggested scores of interesting product ideas. Chemical firms have mentioned such items as piping and test tanks. And readers of the horizontal publications have offered ideas ranging from mufflers for cars to tail gates for dump trucks.

Over 40 tests have already been made by the chemical and allied process industries. More than 63 per cent of these tests, made by some 70 different companies, have opened paths to what Pfaudler officials believe should be new markets. Tests being made by many other firms in space, construction, petroleum and other industries also promise interesting results.

The Pfaudler organization, which has world-wide sales of about $63-million, doesn't expect immediate prosperity from Nucerite's introduction. But results indicate that the company will be supplying the new material in large and profitable volume before very long.

Currently the agency has started up the program once again, in media similar to those used before, and Pfaudler's mailing department is braced for a flood of work.

40 How Ads Help a Company to Diversify

from Printers' Ink

With the second-quarter sales figures just in, Reichhold Chemicals, Inc., is predicting the best year in its 34-year history.

Reichhold hasn't stopped growing since it started its world-wide complex of chemical plants in 1925. In the last five years, advancement has been faster than ever. Net sales in 1954 were $47,029,000, in 1958 they rose to $74,058,000—a 63 per cent again. At the present rate, sales this year could reach $90,000,000.

Why such great growth in a short period? Says one company spokesman: "We can attribute the success to a growth-conscious management and a growing line of saleable industrial chemicals. We can also credit a marketing team that has supported us all of the way.

Advertising's contribution to company growth has been especially apparent in the last five years. Before 1954, RCI's major market was the paint industry, which accounted for about 90 per cent of its output. It supplied the raw ingredients for paints and allied products. But with worldwide and domestic chemical markets expanding, RCI management thought it a good time to diversify—to put some of its own extensive scientific knowledge and international facilities to work in other fields. The success of its diversification is shown by the fact that last year the share of its total sales that went to the paint industry, was only 36 per cent while sales of plastic materials accounted for 33 per cent, and other materials 31 per cent.

In 1954, RCI began diversification. While the physical and organizational part of the program was in progress, RCI began to alert new prospective markets to its new role. This was largely the job of advertising which had to:

1. Tell new classes of prospects about RCI's new lines of chemicals.
2. Inform prospective new customers that RCI was in a broad area of the chemical business.

Reprinted with permission from *Printers' Ink,* Vol. 268, No. 4 (July 24, 1959), pp. 46, 48.

3. Show capability in chemical fields in which RCI wasn't well-known.
4. Alert stockholders and the investment-minded public to Reichhold's new roles and growth potential.

Fulfilling all of these requirements called for a program combining the broadest possible appeals. "We approached the problem from several directions," M. K. Pinkerman, vice-president of advertising, told PRINTERS' INK. "We decided first, to let our ad expenditures grow with annual sales increases. In 1950 we were spending about $184,000 for advertising; this year, we'll spend twice that amount. (About 63 per cent is for business-paper space.)

"Depending on the atmosphere we're trying to create, we change the degree of our advertising," said Pinkerman. "For example, where we might need more corporate advertising one year, we readjust the proportion of corporate to product advertising."

To put over the new image in 1953, the year before actual diversification, and in 1954, the year that it was implemented, about 80 per cent of the budget allotment for business papers went into management and financial periodicals, including some newspapers. The ads projected a corporate theme but were designed around products. One of the ads that year, for example, was headed "Now blankets of fibrous glass warm and cool homes." Although the copy described a special kind of resin binder, it strongly indicated that RCI was in the adhesives business. Another ad in the series described quiet gears made of laminated plastics, thus showing that RCI was also in the plastic business.

By 1956, the corporate advertising had taken on another look. The single-product corporate ads of 1953 and 1954 now covered entire product lines. These were aimed specifically at chemical management, and not all management as a group. Two-color spreads appeared in "Chemical and Engineering News" and "Chemical Week." By 1957 most of the ads were back to putting emphasis on products, although some corporate ads were still included in the ad program.

These ads were designed around a domestic theme, with messages for the chemical industry. The corporate build-up was given more impetus last year with RCI's acceptance to the New York Stock Exchange. A listing on the exchange signifies that a company has met the highest business standards—that it has a sound financial and organizational base. To herald the event, RCI ran a single, two-column ad in the national edition of the Wall Street Journal and in the New York Times. "This modest ad," said Pinkerman, "gave the official sign that our corporate build-up was a success—that we were a major entity in the chemical business."

"There's no particular reason to use corporate advertising steadily," said Pinkerman, "unless action of your stock warrants it. If the stock doesn't rise with industry-wide sales, you probably need corporate advertising. Of course there are many other reasons. Ours was that when you sell to a single industry as we had since 1925, you are accepted there, but not necessarily in the *other* markets you want to reach. In that case, you've got to conduct a program to support your products and build your images."

He added that such a program calls for a diversification of the company's standard advertising practices, with emphasis on the areas important to the company at that time. "Our corporate advertising was used as a broad selling program," he said.

Now launched as a multi-line chemical company, RCI intends to continue to emphasize sales—but with a lot of help from advertising. Said Pinkerman: "Since our products are industrial chemicals, we have to sell our technical know-how through sales engineers and technical salesmen who can give the on-the-spot services necessary to our type of company. But for maximum saturation, recognition and sales stimulation, we're going to continue to rely heavily on our advertising."

Of all the problems confronting those responsible for the administration of the chemical enterprise, one of the most difficult is that of setting a price upon the firm's product. Those responsible for price setting must consider a number of company, industry and governmental policies prior to making the pricing decision. For example, shall the price be set so that a specified return is received on investment?; shall the price be set to maintain or to improve a certain market position?; shall the firm lead, meet or follow its competitor's prices?. Still other problems arise, e.g., how shall the *new* products be priced?; is it wise to cut prices on established products?

Price policies in the CPI are quite heterogeneous, even within one company. In most cases, each product's price is established as part of the overall marketing strategy for that particular product. The following two selections describe how Carbide and Du Pont have set prices on some new and some mature products.

41 Pricing Policy: Union Carbide

by A.D.H. Kaplan, J. B. Dirlam and R. F. Lanzillotti

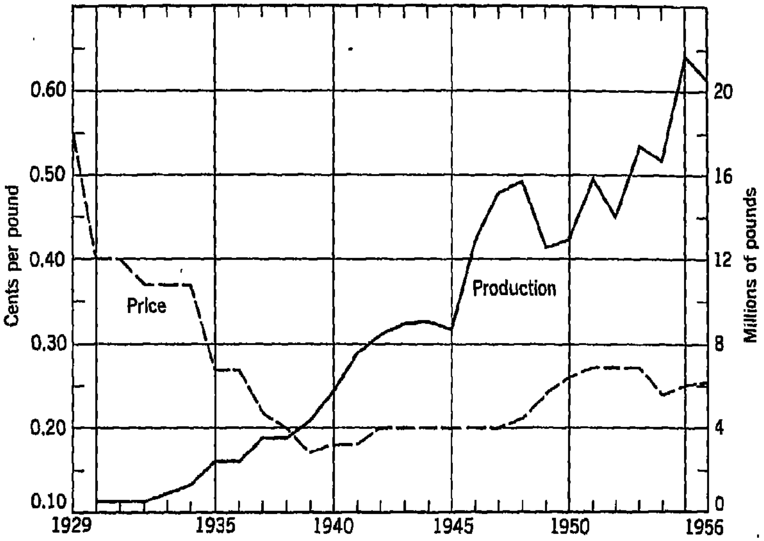
New Products

In pricing new chemical products, Union Carbide uses engineering estimates of expected costs at different volumes of production. With this information as a guide, the company frequently approaches potential customers to ascertain the volume of the new product that might be taken at various prices. The final determination of the introductory price may be guided by the desire to cover the "full costs" at actual output rates, or a desire to stimulate sales. There is no general rule that can be applied to these situations: the prices of some products have been lowered to elicit volume sales, while on other products the company has waited for volume to increase substantially before lowering

Reprinted with permission from *Pricing in Big Business* (Washington, D. C.: The Brookings Institution, 1958), pp. 113–122. The authors are on the staff of the Brookings Institution.

prices. The determination of a margin over cost is probably influenced in the first instance by the experience of the division with similar chemicals. The actual price may fall short of the ideal profit target if direct competition has to be met; if the product is unique, a price acceptable to the market may yield a return higher than the division's average.

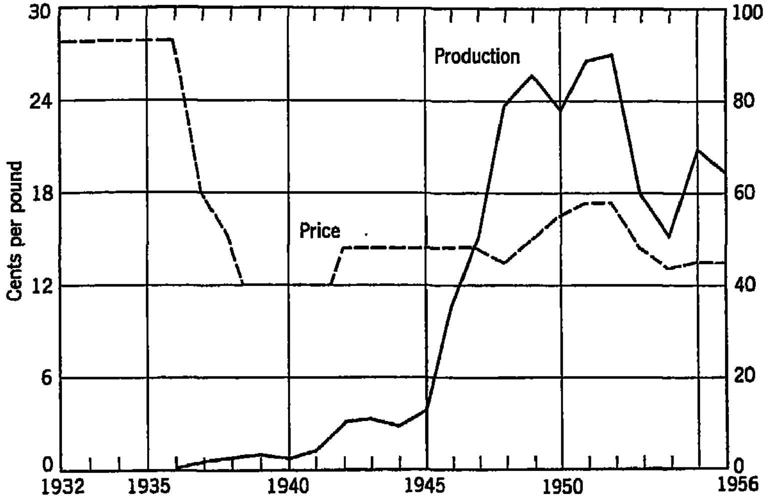
There have been numerous examples of new chemical products, or familiar products developed from synthetic processes, the prices of which have been reduced drastically, opening new areas of demand and making possible expanded output at progressively lower unit costs of production. Two examples cited by Union Carbide are propylene glycol, a solvent for food flavors, dentifrices, sulfa drugs, and Vitamin D, and triethanolamine, used today as an emulsifying agent for cosmetics and floor waxes, and a number of pharmaceutical products.



Prices and United States production of triethanolamine. (Source: Union Carbide Chemicals Company, Market Research Dept.)

Triethanolamine was first introduced in 1926 at a price of $3.00 per pound to an interested drug firm—a test tube price. Within the year, the price was reduced to $2.00, on the strength of some improvements in production methods. Over the next two years, as production expanded with the tapping of new markets, the price was stepped down to 90 cents and later to 75 cents. By 1929, when mass production really got under way, the carload price was lowered to 55 cents. With an increase in production from 0.8 million pounds in 1930 to 4.4 millions in 1939, the price was further reduced to 17 cents per pound. Following wartime control at 20 cents, the price of triethanolamine rose to a high of 27 cents per pound (1950–52), from which it has since receded.[1] (See the chart on page 380.)

The price history of propylene glycol shows a similar pattern. Union Carbide explained that its policy was to reduce the price of the product in order to increase its market, and between 1936 and 1940 the price dropped from 28 cents to 12 cents a pound. The entry of Dow Chemical into the field by the time Union Carbide had established a market provided a competitive incentive to a further reduction in price by the latter company. There appear to have been two distinct periods of price reduction for this product. In the first period, 1936-41, the reduction was effected as a Union Carbide promotion, but in the 1952-54 period, a drop in price resulted from increased production by the industry generally. Union Carbide classifies this product as one that has reached the "milk business" stage of maturity—that is, with relatively settled volume and prices. (See the chart above.)



Prices and United States Production of propylene glycol, industrial grade. (Source: Union Carbide Chemicals Company, Market Research Dept.)

Union Carbide's experience with a chemical[2] first placed on the market in 1945 affords illustration of successive reductions in price as volume expanded and former customers entered into the production. The product was introduced at 55 cents a pound and had three customers, the largest of which took the bulk of the first year's output of 100,000 pounds. By 1947, industry sales amounted to 1.3 million pounds, and the price was lowered to 50 cents when competitive producers, including a former customer of Union Carbide, entered the market. In 1948, total production increased to 2.5 million pounds, and the price fell to 40 cents—close to the break-even point for Union Carbide, which was then utilizing only 20 per cent of its plant. The price held until the end of 1950, when it rose to 46 cents—a figure estimated by the company to be the break-even point at the current operating rates. In December 1951, a uniform delivered price of 47 cents was adopted by Union Carbide. Increased production, greater realizations from by-products, and more efficient conversion processes brought the price down successively to 44 cents in 1953 and 40 cents in 1957, when production was at an annual rate of 15 million pounds.

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[1] The price quoted as of May 1957 was 22 cents.

[2] Identification withheld.

Mature Products

The general stability of chemical product prices after the product has reached the mature stage of its life cycle is exemplified in the price curves of five products shown in the chart on page 383. These products were initially priced at introductory levels before settling down to the tank car prices shown in the chart. For example, ethylene glycol was priced at $1.00 per pound in 1922, which was higher than the price of glycerin with which it competed. Even though ethylene glycol had properties superior to glycerin, when it reached the commercial production stage, it had to be priced below cost in order to stimulate demand; the price was dropped to 27 cents a few years after introduction (to compete with glycerin at 20 cents) when cost was 35 cents. Within two years, sales increased sufficiently to lower costs to 25 cents, and at that point the price was also reduced to 25 cents. In 1941, with the entry of more and more producers into the field, the price was 12 cents per pound. Since the end of wartime controls, the price has fluctuated between 11½ cents and 18 cents.[8]

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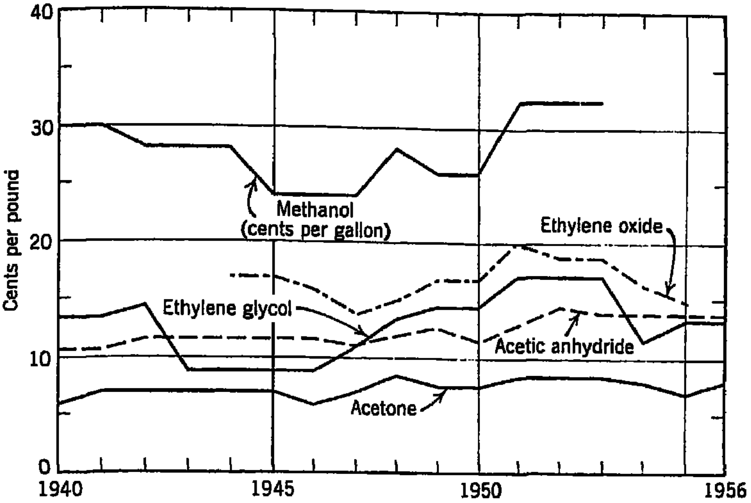
[8] The price career of ethylene glycol is not to be confused with that of Union Carbide's branded end product "Prestone" antifreeze, which has been sold over the past 25 years at the following prices per gallon:

May 1, 1933	$2.95	Jan. 31, 1948	$3.50
May 1, 1935	2.70	Jan. 15, 1951	3.75
April 17, 1937	2.95	April 1, 1954	2.95
April 1, 1939	2.65	Feb. 11, 1955	3.25



Tank car prices of selected chemicals, 1940–1956.

The prices of individual products, such as those given in the chart, reflect significant differences in margins over estimated cost, depending in part on the ability of other chemical companies to supply equivalents or near substitutes. In determining a "satisfactory return on investment" in the organic chemicals field, the management is conscious of the risks associated with rapid obsolescence and unpredictable deterioration of the plant.

As a raw material supplier with no control over end-product markets, the chemical producer, it was explained, must provide for the possibility that at any time some new product offering or process improvement may upset established positions in the market, thus making obsolete the plant facilities and equipment involved in their production.

A recent example of effects in this technological competition is acetone. Long a stable earner for the company, acetone dropped in price a half cent per pound (from 8½ cents to 8 cents) in April 1954, reflecting in part the impact of the slump of 1954, and portending the decline to follow. In November, the price broke to 7½ cents as a result of the disposal of a surplus of 50 million pounds of acetone (total annual industry production was about 477 million pounds), by three new producers of phenol by a process which yielded acetone as a by-product. The price reached 7 cents in February 1955 and in March 1956 recovered to 8 cents, the price in effect today. At this price, acetone yields a return that management regards as falling substantially below a reasonable return on chemicals.

As the foregoing examples have indicated, there is an identifiable "life cycle" associated with the pricing of chemical products. Union Carbide noted that most of its chemicals have gone through a "test tube price to tank carload price" period. In the case of triethanolamine, the period was about five years, but one year has been more typical among recent cases. Having probed the farthest reaches of demand, chemical products (*e.g.*, methanol, ethylene oxide, ethylene glycol, acetone, and acetic anhydride) tend to fall into a pattern of cost-plus pricing, some providing quite ample margins above average cost while others, exposed to aggressive competition, may have to be carried by the more profitable lines. Some of the oldest products, however, still rank among the most important in terms of profits as well as dollar volume.

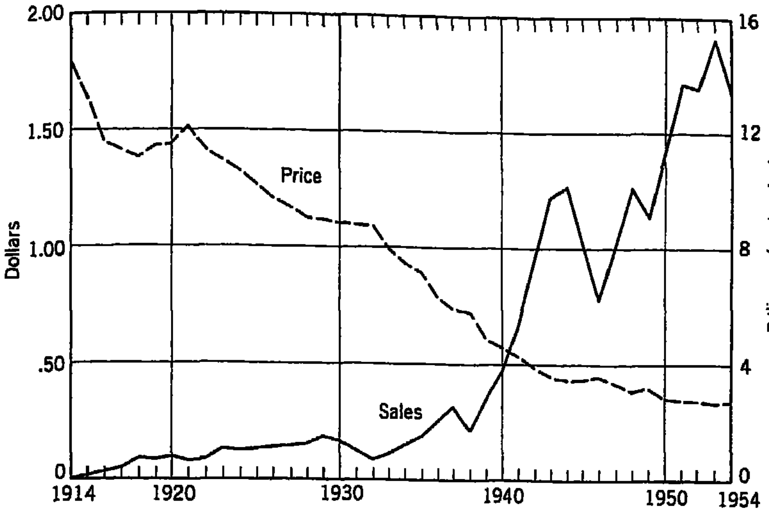
Industrial Gases and Related Apparatus

The main products of the Linde Company—another principal division of Union Carbide—relate to the extraction of various gases from the air: oxygen, nitrogen, argon, and the rare gases helium, krypton, neon, and xenon, all of which have a great variety of industrial uses. The largest consumer is the metal industry (especially steel), which uses many of the gases for cutting, shaping, conditioning, heat-treating, and welding. In addition, Linde supplies numerous types of manual and automatic equipment for these operations.

Oxygen

Linde's production of gas products, and of oxygen in particular, is essentially an extractive processing operation. Prices are based on standard costs determined from engineering estimates and experience cost curves at different rates of utilization. Generally speaking, the pricing of these products represents a range from low volume with relatively high margin (the rare gases) to the large volume and relatively low margin of the more widely used gases like nitrogen and oxygen.

Oxygen production has passed through several stages of technological development, and in the process costs, prices, and margins have been reduced as volume increased. Gaseous oxygen was first produced by Linde in one large plant and shipped to users in heavy containers under



Oxygen prices and sales, Union Carbide Corporation, 1914–1954.

pressure—twenty pounds of product in a 133-pound container.[4] While both the product and the art of using it effectively were new, the company found it necessary to sell "service" with the product. At this early stage, oxygen in gaseous form was sold in small quantities at a relatively high price. To stimulate volume, the company turned to a policy of relatively low margin and constructed small plants near points of heaviest use. By 1929 about one hundred were in operation, most of them with an annual capacity in the range of 1½ to 5 million cubic feet, with a few around 10 million cubic feet. The price was lowered from around $1.80 per 100 cubic feet in 1914 to $1.13 in 1929. But transport and handling costs still constituted a large proportion of the final delivered price to users. (See chart.)

Heavy users of oxygen, especially the metal industries, pipeline contractors, shipbuilders and railroads, found it inconvenient and costly to use the cylinder product. In 1932, after five years of experimental work, Linde met the problem of high transport and handling costs by developing a liquid oxygen distribution system. Linde produced liquid oxygen in large plants and later gasified it at the various sites near points of use. (Linde's Kittanning, Pennsylvania plant currently has a capacity of over

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[4] The discussion of oxygen pricing refers to high purity oxygen, which is a product of bulk use. The company's oxygen, meeting U.S. pharmacopoeia standards, must have a purity of at least 99.5 per cent.

450 million cubic feet per month.) Industry found this liquid oxygen system much easier to handle and less costly; as a result some important new uses were developed (*e.g.*, conditioning of steel), and consumption generally increased. Reductions in price continued through the 1930's into the Second World War. After four decades (1914-54), during which several important technological changes occurred, the price of oxygen was steadily lowered to 35 cents per 100 cubic feet, down 81 per cent from the 1914 figure.

The major volume of Union Carbide's (Linde) oxygen sales is direct to large users, although the sale of oxygen in cylinders by Linde distributors is of prime importance for small user accounts.[5]

In preparing an industrial gas product price schedule such as that for oxygen, the company considers the following items which go into standard costs:

Plant Cost. Normally, plant cost is determined from previous operating experience modified by engineering estimates.

Distribution Expense. Distribution costs are of major importance when a product is sold on a delivered-price basis.

Experimental and Research Costs. These costs are generally relatively high with a new product and are given consideration on a forecast basis rather than at the high initial costs. In the case of established products, the research laboratory program is usually fairly well stabilized, and costs thus can be considered on a current or historical basis.

Selling Expense. The company charges selling costs in one of two ways, depending on conditions of sale. In cases where specialists are selling one product, actual expense is readily determined; where salesmen are selling a variety of products, the allocation is made on the basis of time studies.

[5] A leading factor in the postwar continuation of price reduction has been the increasing scale of oxygen use, particularly by steel companies seeking to increase with oxygen the steel output of their furnaces. The economies of scale are notable when supplying oxygen—particularly so when cylinder oxygen (in containers 8 times the weight of the compressed gas) is supplanted by oxygen piped into the consumer's plant.

Quite recently Union Carbide has moved to a new development in oxygen sales, relying on a combination of gaseous oxygen generated on the consumer's grounds for basic supply, with liquid oxygen supplied for supplementary requirements.

The pricing of oxygen is thus intimately associated with the types of facilities for generating and distributing oxygen which can be set up for a given type of consumer. This is an area in which a new competition of processes and corresponding unit costs has developed. An example of the fluidity of the situation is the offering by other companies of relatively mobile oxygen generating equipment, which is purchased by consumers who then proceed to make rather than to buy.

On established products, the company finds it relatively easy to estimate selling expense by either of the two methods indicated. On new products, however, initial marketing costs are much like initial research: the company makes its estimate or projection of such costs as of the time when the product is established in the market rather than the high initial costs.

Depreciation. Depreciation allowances are determined from engineering estimates of equipment and installation costs using established depreciation rates.

General Overhead. Auxiliary, Administrative, and General Expense is usually assigned by taking a flat percentage of all other costs.

Profit Margin. The margin added to the above costs is estimated on the basis of expected return on *total utilized investment.* The determination of the desired return is commonly related to the age of products: in an old established market which is highly competitive the margin is largely governed by the competition, whereas in relatively new products, the initial return is normally higher than the average for established products.

42 Pricing Policy:

E. I. du Pont de Nemours and Company

by A.D.H. Kaplan, J. B. Dirlam and R. F. Lanzillotti

As it expanded rapidly from the explosives line, du Pont was confronted with the problem of devising pricing techniques for a widely diverse and far-reaching product line.[1] This is in contrast with U.S. Steel, which has always priced for much the same group of similar commodities. Like Alcoa, although du Pont's range of products is much broader, du Pont faces the competition of substitutes to which the price response must be adjusted on a case-by-case basis.

Furthermore, du Pont not only acquired heavy chemical and paint companies as going concerns with fully developed pricing systems; it was also active in perfecting inventions originating outside the firm (ethyl and freon); and it created, at great cost, such novelties as duco, nylon, and its successor artificial fibers. Moreover, it entered into agreements with Imperial Chemical Industries and La Cellophane to use their patents and processes in this country and, in so doing, substantially improved some of their original products. The mature products, acquired by the score, and the newly created or improved products could not be forced into the same pricing mold.

In a compilation of pricing methods employed in various du Pont divisions, the company brought to light the indifference that evidently had attended the pricing of many products. While subordinates were familiar with the basis for pricing products they sold, it appeared unnecessary for top management to review the pricing of items that were profitably produced and presented no problems to the sales force. Only

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[1] Du Pont carries a variety of products in each of the following departments: electrochemicals, explosives, fabrics and finishes, film, Grasselli Chemicals (heavy chemicals), organic chemicals, photo products, pigments, polychemicals, textile fibers.

when strategic decisions had to be made—such as the way in which price must change to satisfy the requirements of the cement decision, or whether a general movement of prices was necessary—would the higher du Pont officials be likely to concern themselves with the pricing of such things as formaldehyde or paints. Sometimes the origin of prices was lost in the unrecorded history prior to the acquisition of the producing unit by du Pont. Guides based on margin of profit, if they were used at all, were employed in such cases for the purpose of internal control of efficiency, not for setting prices.

Some indication of the diversity of pricing problems facing this company is evident from an examination of the geographic pricing systems used by the company. The variations range from strictly f.o.b. pricing through various stages of freight-equalization to strict "postage stamp" pricing.

Policy Goal

Du Pont has stated that: "Our objective is to build for the long term solid markets which will stick to our ribs through periods of adversity as well as prosperity. We are not interested in temporarily exploiting our customers, who are our most precious earnings asset."

As to its general formula for pricing, the element of cost-based pricing must enter into the price for both new and established products.

> Our price is based upon the obvious elements of conducting a business. The probable factory cost of manufacture is calculated. Expected sales and distribution charges are added. We then consider what return on investment is desirable, appropriate and consistent with our own long-term risk and tax exposure, and, finally, we make an appraisal of the use value of the product to the consumer, as well as of its worth in relation to competitive counterpart or alternate materials. The end result is usually a compromise of these various factors. On occasion, I have even relied upon my feminine intuition to establish a price for a new article.[2]

Implicit in du Pont's over-all pricing policy is an assumption that its product mix is in continuing flux, as the most profitable use of its investment is sought.[3] In keeping with this policy, the company seeks to retain operations only in those mature and established products for which, under competitive conditions, the firm is a low-cost producer and can enjoy a satisfactory return. Ideally, an established product for which the price must fall below the level of a reasonable target return, stability considered, will be dropped and give way to expansion in more promising directions.[4] A case in point is du Pont's changing objectives in certain areas of rayon production—where prevailing prices have brought profits down to a level which, from the company's standpoint, does not merit continuing production. In 1955, it began converting its Tennessee rayon plants by replacing the rayon equipment with equipment for production of nylon cord and other fibers that hold greater promise of satisfactory returns.

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[2] From a prepared statement to a visiting group by Mr. Kinsman of the du Pont Executive Committee.

[3] "Profitability" embraces the durability of profits as well as the rate.

The corporation's Executive Committee, while having a corporate target return in mind, does not expect the same rate of return from all departments. It recognizes differences in earnings potential by product groups; but it expects each to approximate an optimum rate in the light of such facts as the age and degree of stabilization of the product line, the elasticity of the demand, whether the product is mainly for use by other departments in du Pont, or whether it is a by-product of another du Pont product.[5]

Approval is sought from the Executive Committee on *general* upward or downward movements of prices, indicating that the initiation of the change comes from the department concerned; furthermore, department managers stated that, in reaching a desired average return, they had discretion in allocating the returns on individual products. It would be difficult to say precisely who sees to it that the standards are enforced, but it is evident that the *esprit de corps* is relied on to work out that problem more effectively than would a formal fiat.[6]

Price Policy on New Products

The declared price policy of du Pont in respect to its patented and other new products is "to endeavor to increase consumption . . . by aiming at a low profit per unit on a large volume of sales rather than a high margin on a small volume." Patent protection is recognized as an aid in carrying out this policy, since the company thereby "can absorb initial losses from low selling prices with greater assurance that volume thereby created will flow to it." Patented items not excepted, the ability of the company to implement its general pricing policy is felt to be dependent upon market factors entering into the determination of selling prices, "including the fact that every chemical product is competitive with natural or synthetic substitutes." The corollary of the company's innovating policy is that "the industrial departments shall not permit the existence of patent protection to influence higher selling prices than can be economically justified on the basis of the other factors involved."

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[4] Many of du Pont's products are required as raw materials for other branches of the company and are retained when for reasons of convenience or economy the company's own production is a better alternative than the purchase of the product from others. On the other hand, the company purchases calcium carbide and facilities connected with its further processing from its chief competitor, Union Carbide, although obviously du Pont could produce its own calcium carbide if that appeared preferable.

[5] There was a suggestion that overhead is allocated to different departments on a "handicap basis," according to the ability of a product group to carry the load.

[6] Discussion with the head of one department having a preponderance of mature products indicated that no one at the department level could say with authority how investment was measured—which would leave the rate of return, in the area of heavy chemicals at least, a rather nebulous part of the pricing formula.

In respect to the target return that the profit margin should provide, the company has stated that its policy takes account of the "character of the contribution" that the product makes:

> If our contribution of an improved or new product is an exceptional achievement because of long and expensive research and development and a high permanent investment hazard, and if it affords profitable opportunities to consumers or converters, we feel we are entitled to an exceptionally good return and we ask a corresponding price for it. If our contribution has been only a moderate one, then we determine upon a price that will give us a profit consistent with our work, effort, and risk.

Price Policy on Mature Products

Price-making in basic chemicals and paint illustrates du Pont's policy in dealing with mature products. In established lines of heavy chemicals, like those inherited by du Pont through its acquisition of Grasselli, a substantial portion of the output supplies other sections of the du Pont operation for further processing. The portion that du Pont sells to outsiders is usually marketed at prevailing prices. The company shows little concern for an increase in its market share or an expansion of the sort that it has enjoyed in exploiting its own pioneer efforts in cellophane or neoprene. It is not as a rule expected that these mature products will benefit to any large degree from research or new markets; sulphuric acid and formaldehyde offer little prospect for revolutionary development.

The basic paint business and its price structure were inherited by du Pont when it acquired Harrison Bros. & Co., Inc., in 1917 in order to capture a supply of heavy chemicals required for making munitions for the Allies in the First World War.[7] There is no evidence of du Pont price leadership in respect to standard paints. To all outward appearances, du Pont has concentrated on merchandising techniques, improvement of equipment and maintenance of the department's position as the maker of a quality line of paints, in conformance with the standard for other products made by the company. The paint division seems to have accomplished the task of growing under these conditions, perhaps finding itself under a profitable price umbrella furnished by the industry as a whole. A question regarding the logic of retaining the paint business as part of the du Pont product mix brought the response of a company executive that he regards the paint business as one of the more satisfactory of the company's lines, having in mind the relative ease and stability of returns against the company's invested capital therein. Nevertheless, in the special subarea of automotive finishes, the attitude toward prices is less passive; the company has a policy of pushing for product improvement and volume increase, usually accomplished however, with relatively stable pricing tactics.[8]

Active, therefore, in many lines and many industries, with a corresponding variety of methods of price-setting, du Pont sells a number of standardized products having little prospect of being dressed up, either through innovation or improvement of service facilities, and others somewhat more differentiated (but not originated by du Pont), the prices of which apparently are beyond its control. Because of this the company regards its price policy on these standard products as simply that of "meeting competition," in contrast to new products which are expected to meet a rigorous return and pay-out test. Yet the foregoing explanation undoubtedly over-simplifies the target return as it is actually applied. Du Pont spends millions each year on research, constituting an overhead that must somehow be recovered from all of its products. Assessing each "new" product with its fair share of the research that has been done in all areas is not easy and necessarily involves some arbitrary judgment.

There is no question that the Executive Committee makes careful estimates regarding possible return before it engages in the large-scale investment necessary to put a new product into commercial production. Widespread testimony to this effect was found among those interviewed at du Pont. Moreover, the company has stated that in fixing prices on a new product it attempts, roughly, to adjust the rate of return to the riskiness of the investment in the discovery. The company's idea of a reasonable return cannot be compared with that of GM or International Harvester. We do not know what du Pont regarded as a proper rate of return or what it has obtained in the past—on specific products other than cellophane—and therefore it is not known whether the realized returns were also the target.

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[7] The continuance of the paint business was probably due in the first instance to the company's reluctance to leave as an orphan of the war the original labor force of Harrison Brothers and the community area in which is supplied the chief means of employment. Yet, Harrison Brothers might well have been re-sold after the war if a suitable buyer had been available. In any event, du Pont chose to retain the paint company, and with the years it has apparently remade it into the image of a du Pont department.

[8] Price indexes for representative paint items disclose the frequent price adjustments in this particular field. The upward drift of prices can be attributed in large part to changes in direct costs, *e.g.*, titanium oxide, leaded zinc oxide, glycerin, containers, and labor.

The company's tendency to take for granted its old and mature products is a counterpart of its intense concern with the fate of its newly developed products. One is to a limited extent dependent on the other. The company can simultaneously develop only a limited number of products. But there are gradations between the products whose prices are virtually forgotten, those which have to be reviewed from time to time by a minor official to make sure that they are in line with competitors, those facing substitutes, which can reach a profitable market only by moving into it through price reduction (like cellophane), and those which (like nylon) have expanded output into many areas because of their unique qualities, without price concessions.

How does this multiplicity of procedures crystallize into a price policy? It is hard to characterize du Pont's policy in a single phrase; obviously, though it does try to achieve a target return on the investment in some products, this target is a variable one—much higher for new and riskier items than for old products—and in fact it hardly seems to receive consideration for a multitude of items. The company is geared to growth and research; the latter influences price policy only in so far as there is exploitation of those pilot products that pay off commercially. In effect, the company comes close to charging, over the long run, what the traffic will bear; a target return is something that is achieved only on an over-all basis, by mixing the high-return with the low-return products.

It is necessary to avoid oversimplification in pigeonholing even the new products. It is possible to compute the total net earnings on the cellophane investment, yet these reflect pricing of cellophane in different markets where different standards rule. The same observation applies to nylon, which with different deniers can be used for different purposes, and which accordingly carries different prices. They may or may not embody the same target return policy; they reflect a policy of meeting competition where necessary, as in the tire market, and taking advantage of definitely established superior quality, as in hosiery.

Aside from the policy problems affecting price setting, there are a number of procedural aspects that must be examined. For instance, the firm's management is confronted with questions such as, "How shall we organize for pricing?;" "Who shall set the prices?"; "Shall the prices be set by the sales manager, controller, product manager, general manager?"

Generally, there is no set procedural policy for pricing in American industry, and this includes the CPI. A wide variety of systems are used, ranging from those in which top management makes all the decisions to those where the product manager and salesmen are given authority to administer prices. However, among the large CPI firms, it is common to find that the responsibility for pricing is delegated to what can be called "middle management," that is, department managers and division executives as opposed to corporate executives. This is a reflection of the fact that many large CPI firms are so diversified in terms of products manufactured and customers served that only those people reasonably close to the market have sufficient knowledge to make suitable pricing decisions. This is true, for example, of Union Carbide, Du Pont, General Electric, Standard Oil of New Jersey, Johns Manville, and General Foods. The pricing organizations of the first two of these CPI firms are presented in the following two selections.

43 Pricing Organization: Union Carbide Corporation

by A.D.H. Kaplan, J. B. Dirlam and R. F. Lanzillotti

Union Carbide was essentially a holding company until after the Second World War. During the period 1948–1952, the leading subsidiaries—National Carbon, Bakelite, Electro Metallurgical Company, Carbide Chemicals, and Linde—were made operating divisions of the parent corporation. With increasing size and complexity, a major problem of the corporation has been the need for greater co-ordination of certain operations in what has for many years been a decentralized enterprise.

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The Appropriations Committee is the key policy-making group, controlling the corporation's purse strings. Apart from the annual budget sessions with the division heads, the committee receives copies of the monthly operations reviews that are prepared by the various divisions. These reviews do not discuss pricing as such but do include a presentation of the operating statements of each division, in total and broken down by individual products. These data enable divisional comparisons to be made, product by product, of the forecasted and actual returns on utilized investment and sales. If price changes are mentioned, they would be by way of explanation of operating results.

In addition to the above, the Appropriations Committee meets frequently in informal "Chart Sessions," scheduled so that each group of products can be reviewed at least once a year. These sessions provide an opportunity for the committee to meet with individuals in the operating divisions who are primarily responsible for the products that are the subject of the meeting. These sessions have nothing directly to do with pricing. If the subject comes up for discussion, it is principally to help explain the profit picture, or possibly to explain why a price change has taken place, or why one may be contemplated for the future. The Appropriations Committee likes to be kept informed of changes only in cases in which there may be sizable effects on profits, but there is no general requirement that the committee be informed in advance of any changes. It is the attitude of the corporation that the divisions are held responsible for profits and must therefore be given the right to determine their selling prices.

Another kind of corporation review of divisional operations is through actions on requests for capital expenditures. When additional facilities are under consideration, data covering sales quantities, selling prices, and related information must usually be reviewed in order to provide a basis for decision. In this process, both the division and the corporation may be alerted to problems of consistency between divisional prices and corporate profit objectives.

In so far as production research, pricing, and sales are concerned, divisional autonomy is the rule. In the pricing of alloys and metals, for example, prices are reviewed by the vice president for sales of the Electro Metallurgical Company, who in the matter of major price revisions makes recommendations to a management committee (of which he is chairman) and to the president of the company. In the initial stages of pricing a new product, other departments are consulted, but ordinarily prices are set by the sales management. No delegation of price authority is made down the line to sales managers or salesmen.

In Linde, the pricing of industrial gases is the responsibility of the vice president and general manager. He consults with the gas sales manager and manager of apparatus sales on questions arising from monthly sales and cost reports. Regional sales managers are also brought in for consultation, but they have no authority to make price changes in the field. On general price revisions arising out of major changes in costs, the president is informed before the changes are effected. In the past few years, there has been an increasing degree of product line autonomy with respect to pricing, production scheduling, and development programs. The manager of gas apparatus sales has authority to make price changes without going to the vice president and general manager; only in cases of general price revisions cutting across product lines of the company would this referral normally be necessary.

In pricing chemicals, the organizational picture is much the same as presented above: divisional autonomy with little delegation down the line to salesmen. Because a large proportion of many chemical products is sold to large consumers on a contractual basis, negotiations on price matters are ordinarily pursued at the sales manager or vice presidential level.

The pricing of "Prestone" antifreeze is a special case in which the authority does not rest within a single division. Prices are recommended at the start of each season by a small committee from Union Carbide Chemicals Company, which produces the basic raw material (ethylene glycol), and National Carbon Company, which markets the final product. If agreement cannot be reached by this group, the matter goes to the two divisional presidents, or higher if necessary. The explanation for this special treatment for "Prestone" is that ethylene glycol has many possible end product uses, so the price established for this product, the most important end product, has implications cutting across several divisions of the corporation.

44 Pricing Organization:

E. I. du Pont de Nemours and Company

by A.D.H. Kaplan, J. B. Dirlam and R. F. Lanzillotti

It was indicated earlier that the executive committee of du Pont has always set a fairly strict earnings requirement for the various departments of the company. Its viewpoint in purchasing and operating new departments, as the company diversified from explosives, has been akin to that of an investment banker. The interviews have indicated that in recent years the top management of the company has concerned itself only with general upward or downward movements. Pricing is apparently done far down the chain of command. Departments are composed of divisions, which in turn are organized on a broad product basis; thus, the Fabrics and Finishes Department has a Fabrics Division and a Finishes Division. Yet, the general manager of this department has only an advisory role in setting prices for paints. Price setting is the responsibility of the director of sales in the Finishes Division, who is subordinate to the division manager, whose superior is the general manager of the department.

Du Pont, like other companies in its size bracket, attempts to establish machinery for continuous price examination to minimize the number of crisis situations demanding emergency action or quick improvisation. The aim is to sense a trend or change in costs or demand before the situation reaches a point at which the possibility of careful planning is lost. To this end, the responsible administrative official for each functional aspect of the product operation is kept in touch with the problems and the thinking of his colleagues. The procedure may be illustrated by reference to one of the major product group departments—the Film Department. (See chart on page 398.)

The ultimate responsibility for the price of a product within the department rests with the general manager, who depends on the director of sales for the pricing operations. In building a price or making a price change, the general manager has frequent informal meetings and a formal monthly meeting with those directors of function in the department who can contribute to a pricing decision. These include: (1) the

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Organization, Film Department, E. I. du Pont de Nemours and Co.

- General Manager
  - Assistant General Manager
    - Control Manager
      - Assistant Control Manager
        - Accounting Section
        - Office Service Section
        - Planning & Scheduling Section
        - Standards Section
    - Personnel Manager
      - Assistant Personnel Managers (2)
    - Director of Production
      - Assistant Director of Production
        - Production Manager ("Cel-O-Seal" & Sponge)
          - Columbia (Sponge)
        - Yerkes (Cellophane, Polyethylene Film, "Cel-O-Seal" Bands, Sponge Yarn)
        - Circleville ("Mylar" Polyester Film)
        - Clinton (Cellophane)
        - Old Hickory (Cellophane)
        - Spruance (Cellophane, Acetate Film)
        - Cellophane Technical Section
    - Research Director
      - Assistant Research Director
        - Development Section
        - Patent Section
        - Wilmington Research Laboratory Director
      - Assistant Research Director
        - Yerkes Research Laboratory Director
    - Director of Sales
        - Special Assistant
      - Assistant Director of Sales
        - Promotion & Advertising Section
        - Sales Development & Technical Service Section
          - Associate Manager
          - Assistant Manager—Sales Development
          - Assistant Manager—Technical Service
        - Trade Analysis Section
      - Assistant Director of Sales
        - "Cell-O-Seal" Sales
          - New York District Manager
        - Converter Film Sales
          - Assistant Manager
        - Export Sales
          - Associate Manager

Industrial Film Sales
  Assistant Managers (2)
Packaging Film Sales, by district: Central—Chicago; Eastern
  —Philadelphia; New England—Boston; New York—
  New York; Pacific Coast—San Francisco; Southern—Atlanta;
  Southwestern—Kansas City
Sponge Sales
  Assistant Manager

control manager, a staff officer who represents the sections of accounting, planning, and scheduling, and the formulation of cost standards; (2) the director of production for the department, under whom are the separate product managers or plant managers, for example, for cellophane, acetate film, polyethylene film, spun yarn, "mylar" polyester film; (3) the research director, whose office embraces a product development section, a patent section, and the research laboratories; (4) the director of sales, whose division embraces the district offices for product subgroups, as well as sales promotion, including technical services, advertising, and trade analysis.[1]

A price proposal for a new product or product development may have its start in separate analysis of basic requirements and market opportunities by all four of these divisions. In the case of an established product, the price consideration may develop from an analysis of production costs by the control manager, or of sales experience by the office of the director of sales, who in turn may receive warnings, complaints, or recommendations from district or product sales managers. Any price action that suggests itself to one of these functional departments can be tested or re-enforced by analysis in the accounting or other appropriate section.

A minor price change may be effected by formal consultation between one or two functional directors and the general manager of the department. A major decision will be reserved for a more formal meeting in which all the directors of the department may participate.

The general manager makes a monthly report on the progress of his department to the executive committee of the du Pont corporation. The report presumably notes any appreciable price changes. When the probable effect of the change is a need for new financing or the change is a response to the financial problem brought before the corporation, reporting the price action is required. In practice there would also be consultation with the appropriate member of the executive committee whenever the general manager felt the need of consultation, or at least believed that preliminary discussion of a special pricing problem with an executive committee member would be prudent or helpful. Thus, it rarely happens that any significant price change will have been made before coming to the attention of someone in the central corporation, who is recognized as a policy consultant appropriate to the area of the problem.[2]

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[1] The group may include the personnel director, if the basis for the change lies in an increase in wage rates or other factor affecting the labor force. The personnel director also attends the monthly meetings, where he listens in for information rather than participates in the decisions.

A factor in pricing of du Pont products, developed over recent years, is the maintenance and regular examination by departmental executive groups of a system of charts, which reveal trends in the level of activity for business generally and for the industries on which the particular departments are dependent, the purpose being to determine the effect of these trends on the returns to the corporation. These are in addition to the internal charts kept by a department concerning its production, sales, profitability, expansion trends, and financial requirements. The analysis and discussion of these factors may contribute to a general upgrading or downgrading of the price structure of the department apart from any price change made on a specific product.

Discussion with the Rayon Department suggests that, within the general procedure outlined above, there may be considerable diversity among departments in the procedures used in keeping with the investment philosophy of top management. It may be that the authority for pricing rayon, nylon, or cellophane may rest at a different hierarchical level *from that of the products pricing authority in the Fabrics and* Finishes Department. The manager of one department was forthright, however, in saying that the determination of prices and rates of return on the large variety of products under his control rested entirely with him, top management supervision being at a minimum.

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[2] In connection with the running battle in recent years of the various acrilic fibers developed by competing chemical companies, the introduction of one competitor's product was pushed by a sharp price reduction that enlarged the differential between it and the corresponding du Pont product. In the case cited, opinions in du Pont on effective countermoves ranged from a strict holding of the line at du Pont's higher price, with continuing emphasis on du Pont quality, to a direct meeting of price at the expense of profit margin. (The spread in price between the two products was roughly between \$1.40 and \$1.75 per pound.) The price decision had to resolve this question: How far could awareness of the superiority of the du Pont product be carried over into consumer willingness to accept a spread between the prices of the du Pont and the competing fiber? In this case the product manager's first determination, resulting from a department conference, was tested in an informal consultation with a member of the corporation's executive committee. It resulted in a final determination by the general manager of a price approximately 7 per cent above the figure to which the competing fiber had been reduced. The formal decision was that of the general manager.

This case outlines the factors surrounding the determination of the price of Hudson Chemicals new product "Aqua-Pur." Aqua-Pur is a boiler feed water additive, and although new to Hudson's line is not unique to the industry that it serves. Since Aqua-Pur is technically superior to competitive additives, Hudson's management is convinced, and rightly so, that the price policy established for Aqua-Pur will be the most significant factor in the additive's success.

But, what price shall Hudson set? If a price is set so as to cover the costs of producing and marketing Aqua-Pur, at what production and sales level shall these costs be computed? Obviously, costs per unit decrease as production and sales increase (in the short run and to a reasonable range beyond the break-even point).

Shall Hudson merely try to meet its competitor's price? But what if the competitor retaliates by price cutting, and how can Hudson penetrate a new market without offering more than a superior product?

Other alternatives are discussed by the authors; however, no solution is presented. What would the reader do?

45 Hudson Chemical Company of Canada Limited

by David S. R. Leighton and David H. Thain

Hudson Chemical Company of Canada Limited commenced the manufacture of a product brand-named "Aqua-Pur" early in 1958. Aqua-Pur was a chemical agent used as part of the softening process for commercial boiler feed water. Of immediate importance to the company's executives was the problem of establishing a pricing policy. The company was at a severe competitive disadvantage, as their competition was an established

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firm who had enjoyed a virtual monopoly in the industry over the past 20 years. The general manager knew that the establishment of a sound pricing policy would be instrumental in determining the company's success in entering the Canadian market.

Hudson Chemical Company of Canada Limited was a wholly-owned subsidiary of the Hudson Chemical Company Incorporated, a large U.S. chemical firm with annual sales in excess of $500,000,000. The company, in addition to its eight plants in the United States, operated subsidiary firms in seven countries including Canada. On a consolidated basis Hudson's total assets were reported at just under $300,000,000. For some time the company had been noted for its excellent research and development facilities which were thought by many to account for its spectacular growth over the past 25 years. As a result of this research, Hudson had followed a policy of wide diversification within the chemical industry.

Hudson's largest foreign operation was in Canada where Hudson Chemical Co. of Canada reported sales of almost $10,000,000 a year. This firm operated one plant in Montreal but distributed its products nationally. The sales organization was divided into six product groups, each with a product manager and from two to five specialized salesmen. In 1958, the water treatment product group was relatively small, although the company felt it had great potential. In addition to Aqua-Pur, the group handled a chemical fungus control for industrial water treatment and two other products, both of which represented relatively small volumes.

Most industrial concerns operated their own boiler plants and were continually facing the problems of treating boiler feed water. In hard water areas the problem was acute, as the chemicals within the water formed a sediment inside both pipes and tanks. Eventually this sediment clogged the system and often forced a program of costly replacement. To overcome this, many firms installed water-softening devices on their boiler systems. Water softening was simply a chemical process which removed the hardening chemicals from the water before it was fed into the boiler.

In the late 1930's, Chicago Chemical Company developed a compound to be used in conjunction with the regular water softening chemicals. This product did not in itself soften the water but rather dispersed the water-softening compounds, thus lengthening their economical life. It provided not only a saving in water softening chemicals but also a reduction in the time and effort required to continually regenerate the softeners. Chicago Chemical patented the product in both United States and Canada under the name of Purafax.

Chicago Chemical was a relatively small firm specializing in certain water treatment chemicals. The company did not manufacture or sell water softening chemicals as such. Trade sources reported that 70% of their business was in the sale of Purafax, while the remainder was made up of a variety of small volume items such as a slime control agent and a fungi control chemical. The company's consolidated statements for 1956 showed sales of $75,000,000 and total assets of $40,000,000.

Since 1946, Hudson Chemical Co. had been working on a compound that would compete with Purafax. By 1952, a satisfactory compound had been developed, but to market it would have violated Chicago Chemical's patent rights. By 1956, however, these patent rights would terminate. Thus Hudson continued work on the product. During this period, two major findings were made. First, it was found that the major raw material in the compound could be extracted from brewer's spent grain. From the brewer's standpoint, this was waste material and could therefore be purchased by Hudson very cheaply. Secondly, Hudson developed an additive for the dispersing compound which would reduce rust formation in the boiler system. A number of the company officers felt this would be an excellent feature when the product was introduced to the market, particularly as Chicago Chemical's Purafax did not contain a rust-reducing agent. It was believed that with these refinements, Aqua-Pur could readily compete with Purafax. Final testing proved that the proper formula for adding Aqua-Pur to softening chemicals was one quart of Aqua-Pur (added daily) for every 10 gallons of water-softening chemical. At this ratio, a 15% saving in softening chemicals should accrue to the firm operating the boiler. A firm operating a boiler might use anywhere from $100 to $50,000 worth of water softener chemicals a year. The company realized Aqua-Pur would only be of interest to firms using between $10,000 and $50,000 of softeners but such a group would represent most of the large production plants in the country. It was not until late in 1957, however, that the decision was made to introduce the product to the Canadian market. The basis for this decision was a study conducted by the market research department which estimated that Canadian sales of Purafax in 1956 had been approximately 6,000,000 gallons, or $4,500,000; a further breakdown of these figures is given in Exhibit 1. The report concluded, however, that the potential was at least four or five times as great.

In preparation for the new product the company hired two new salesmen who were experienced in the water treatment field. These men were to work out of the Montreal office and cover Quebec and Ontario. It was decided that both the Maritimes and the West would be more efficiently handled by distributors, at least until the product became estab-

Exhibit I

Canadian Market—1957 (in gallons)

British Columbia	900,000
Alberta	900,000
Saskatchewan	100,000
Manitoba	400,000
Ontario	2,000,000
Quebec	1,300,000
Maritimes	400,000
Total	6,000,000 gallons

lished in the market. In addition, a man was brought in from the American company to act as product sales manager and be directly responsible to the general manager of Hudson Chemical Co. of Canada. Mr. Roberts, the new product sales manager, had several year's experience in both the development and sale of Aqua-Pur in the United States and was therefore considered a valuable asset to the Canadian company.

Immediately upon his arrival, Mr. Roberts was called in by Mr. Morton, the general manager, and together they started to plan a marketing program for the new product. The first problem was to arrange for tests on the product by independent laboratories in each locality. Until such a time as a favorable report had been received from these laboratories, few customers could be interested in the new product. The company salesmen and the distributor's salesmen would have to contact both company purchasing agents and boiler or stationary engineers to make a sale. The latter had proved to be most influential from the company's experience in the United States.

Based on their experience in the U.S., it was decided that the distributor would have to install a dispenser and storage tank in the client's plant. The total cost of each installation ranged between $400 and $500. While some distributors considered this to be a definite problem, others realized the advantages it provided. There would be a sense of permanence in the relationship of supplier to customers when such a physical installation had been made.

By May, 1958, the company was well along with its plans to enter the Canadian market with Aqua-Pur. Several pilot runs had been put through the plant and a number of independent laboratory tests had been conducted. The results of these tests had been most satisfactory and would act as certification to the company's claim that the performance of their product was equal to, if not better than, that of Chicago Chemical's Purafax. As the product was introduced in each local market, however, additional tests would have to be conducted by local laboratories. The company did not anticipate any problems in this regard. Although price had not been mentioned, the company had obtained favorable reactions from a number of western distributors after a series of informal meetings.

The more Mr. Morton and Mr. Roberts studied the situation, the more they realized the importance of establishing a sound pricing policy from the beginning. Both executives felt that this would be the deciding factor in determining the success of the venture. As a basis from which to start, Mr. Roberts suggested that serious study be given to each of the basic pricing alternatives open to them.

Before considering the alternatives individually, Mr. Morton instructed the accountant to analyze the costs of the new product. The accountant presented the following facts:

1. The cost of direct labor, packaging, and raw materials amounted to 40c per gallon.
2. It was estimated that the new product should absorb $40,000 of general administrative overhead and $20,000 of general factory overhead per annum.
3. Grouped under fixed expenses were the following items:
   —A new 1,500 square foot addition to the existing plant had just been added at an average cost of $8 per square foot.
   —The new machinery for the process had cost $23,000 installed.
   —Early in June a new salesman had been hired which brought the sales force complement to three men excluding the new product manager, Mr. Roberts. Each salesman cost the company an estimated $15,000 per year including salary, expenses and fringe benefits.
   —Two laboratory men had been added, one of whom doubled as a plant supervisor for the new process, at an estimated $12,000 each. Mr. Roberts' salary plus expenses was calculated at $20,000 per year.

Mr. Roberts noted that the present machinery and plant had a capacity to produce 1,200,000 gallons per year, and that an additional investment of approximately $50,000 could double this capacity.

Having these financial facts, the two executives started their analysis of three alternatives:

1. Mr. Morton suggested that they first consider the pros and cons of simply meeting their competitor's prices. He noted that some changes would be necessary inasmuch as Aqua-Pur was in liquid form while Purafax was a powdered substance. However a gallon equivalent to the pound price basis would be all that was required. Exhibit 2 shows Chicago Chemical's price list converted to gallons. It was calculated that on this basis the company would receive an average price of 76 cents per gallon for its product. Mr. Roberts stated that he believed this alternative would

Exhibit 2 *Chicago Chemical Co., Eastern Canada Price List—Purafax (All prices per imperial gallon)*

	Montreal	*Ft. William*	*Toronto*	*Quebec*	*Saint John*	*Vancouver*	*Calgary Edmonton*	*Regina Saskatoon*	*Winnipeg*
Distributor Prices:									
Less than carload in 45 gallon drums	$0.97	$1.15	$1.10	$1.06	$1.10	$1.38	$1.44	$1.36	$1.25
	(.084)‡	(.100)	(.096)	(.092)	(.096)	(.120)‡	(.125)	(.118)	(.109)
Carload in 45 gallon drums	$0.87	$1.05	$1.00	$0.96	$1.00	$1.28	$1.33	$1.25	$1.15
	(.076)	(.091)	(.087)	(.083)	(.087)	(.111)	(.116)	(.109)	(.100)
Tank car	$0.73	$0.90	$0.85	$0.82	$0.85	$1.13	$1.18	$1.10	$1.00
	(.063)	(.078)	(.074)	(.071)	(.074)	(.098)	(.103)	(.096)	(.087)
List Prices:									
Less than carload in 45 gallon drums	$1.47	$1.65	$1.60	$1.56	$1.60	$1.88	$1.94	$1.86	$1.75
	(.128)	(.143)	(.139)	(.136)	(.139)	(.163)	(.168)	(.161)	(.152)
Carload in 45 gallon drums	$1.37	$1.55	$1.50	$1.46	$1.50	$1.78	$1.33	$1.75	$1.65
	(.199)	(.135)	(.130)	(.127)	(.130)	(.155)	(.160)	(.153)	(.144)
*Bulk delivery	$1.23	$1.40	$1.35	$1.32	$1.35	$1.63	$1.68	$1.60	$1.50
	(.107)	(.122)	(.117)	(.115)	(.117)	(.142)	(.147)	(.140)	(.131)
†Tank car	$1.13	$1.30	$1.25	$1.22	$1.25	$1.53	$1.58	$1.50	$1.40
	(.098)	(.113)	(.109)	(.106)	(1.09)	(.133)	(.138)	(.131)	(.122)

*Annual bulk contract or minimum of 500 gallons.

†6,000 gallons shipped from Montreal to customer's plant.

‡*Figures in parentheses ( ) are prices per pound.*

Approximate Net Weight of Drum 500 Pounds

Shipping Precautions

Not injured by freezing (but protect from freezing from Nov. 15th to April 15th). (Consignee to pay heating charges.)

F.O.B. —Above Cities

Terms: —Net 30 days

Federal Sales Tax Exempt.

Prov. and Municipal Sales Taxes extra if applicable.

Containers included and not returnable.

be the most suitable. First, because of its obvious simplicity it would be easy to explain to potential customers and, secondly, he did not feel the company knew the market sufficiently well either to judge the effect on the consumer of a premium price or to estimate what competitive retaliation might result should they cut the price. Mr. Morton was not so sure and, although he did agree it was the alternative involving the least risk, he believed there were strong arguments for another alternative.

2. As a second alternative Mr. Morton suggested that a price lower than Chicago Chemical's might be the best method of getting an initial foothold in the market. He noted that although they could expect some retaliation from Chicago, even a short time lag would be of great assistance in getting established, and in addition, a lower price might tend to enlarge the total market. It could quite conceivably make the product of interest to potential users who then considered it too expensive. Mr. Roberts agreed that this was quite possible and that operating margins at the existing price level were sufficiently large to permit the reduction. However, he noted that to reduce prices would incur the wrath of the softener chemical companies as it would mean further inroads into their sales. In other words, more firms would use Aqua-Pur to increase the life of normal softener chemicals. Mr. Roberts attached considerable importance to this point, as the firms producing softening chemicals were for the most part large and could quite conceivably influence the consumer against Aqua-Pur. Mr. Morton on the other hand questioned the importance of this threat. He believed that the consumer would not be influenced even if the chemical companies launched a campaign against Aqua-Pur.

3. The final alternative that the company considered was that of a premium price. Neither executive was particularly impressed with this possibility but they did recognize some of its merits. In the first place, the rust preventative included in Aqua-Pur gave them an advantage over Purafax. They could price just below what a combination of Purafax and a recognized rust preventative would cost the consumer. A premium price would mean even higher margins and, as a consequence, a lower volume would be sufficient to cover the overhead. This had much to recommend it as, for some time at least, the large Quebec and Ontario markets would be most difficult to enter.

Both Mr. Roberts and Mr. Morton knew that there were other factors that should be studied in each alternative. They also knew, however, that a decision had to be reached quickly if they were to get underway during 1958.

The increasing variety of products handled by CPI firms, together with the growth of these companies and of their customers, has had a marked effect upon the distribution policies of these CPI enterprises. Some manufacturers who in the past have sold directly to the users of their chemical products now deal with these customers through a middleman; other manufacturers, accustomed to dealing through middlemen or distributors, are now selling direct to the end user. In all areas of the CPI traditional channels of distribution are being changed.

The following case illustrates a distribution channel problem relatively common to those firms seeking many outlets for their goods. Here, the Greenfield Company is faced with the need to make a decision among six alternative methods of resolving a distribution policy conflict. Once again, no solution is given; rather, the facts are presented so that the reader can select from the given alternatives or, if desirable, still others.

46 Greenfield Company

by David Faville

In addition to its gasoline and motor oils, the Greenfield Company manufactured and sold a variety of household products such as furniture polish, floor wax, insect exterminator, cigarette and cigar lighter fluid, and a few drug products. Distribution was nationwide. The company was planning an extensive promotional program to increase the number of retail outlets for its household products. Company executives believed that some revision of the distribution policy was necessary.

The Greenfield Company sold its line of household products through company-owned service stations, independent service stations, department stores, hardware stores, furniture stores, chain and unit grocery and

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drug-stores, and other retail outlets of the chain and independent type. Some of the outlets bought directly from the company, while others purchased Greenfield products from jobbers and wholesalers. The type of outlet determined the kind of products which could be sold and no retailer carried the entire Greenfield line. A large portion of the gasoline and motor oil sales of the company were made through company-owned service stations.

The company tried to keep all classes of retailers satisfied with the profit received on the sale of its household products, for it wanted Greenfield merchandise sold through as many retail outlets as possible. However, many of the retailers who bought from wholesalers and jobbers had complained that the system of pricing used by the oil company did not allow them sufficient profit on the sale of Greenfield products. In view of the coming promotional campaign, therefore, the company executives considered the adoption of some new policy which would satisfy all retail outlets.

Under the distribution policy presently in use, the company sold its household products at the same price to service stations, to jobbers and wholesalers, to chain stores, and to large retailers buying direct from it. The company delivered orders to all retailers from its own warehouses, regardless of whether the purchase was made direct or billed through a wholesaler.

Since the large retailers buying from the company paid the same prices that wholesalers and jobbers paid for Greenfield products, they were able to sell these products at lower retail prices than those retailers who bought through wholesalers and jobbers. The latter retailers complained that they could not make a normal profit on the goods when forced to meet the retail prices of the distributors who bought direct. If they did not meet these prices, they often found it difficult to move the merchandise. Because of this situation, many of the retailers who bought from wholesalers would not stock Greenfield products.

The president of the oil company thought that some revision of the price policy was necessary to meet the difficulty. He asked for suggestions from the executive council of the corporation at one of its regular meetings. In the discussion that followed, six plans were presented that sought to satisfy the retailers who bought through wholesalers.

Under the first plan, the company would attempt to equalize the margin of profit received by all retailers on the sale of Greenfield products. It would grant quantity discounts based on the volume of purchases to the wholesalers, who would pass on some of the price benefits received to retailers buying them. The latter would then be better able to meet the retail prices of those distributors who bought direct from the oil company.

One executive protested that under this plan, some independent retailers would be at a disadvantage. They would buy from wholesalers who did not receive any quantity discount because of a small volume of purchases. As a result these retailers would pay a higher price for Greenfield products than those retailers who patronized the favorite wholesalers, i.e., those who received quantity discounts. Also the large retailers and chain stores buying in quantity could still undersell the small independent retailers.

Plan two advocated direct sale to all retailers. Since the Greenfield Company under this plan would charge the same price for its products regardless of the type or size of retail outlet, the executive who proposed the plan felt that maximum distribution would be obtained. The retailers who ordinarily bought through wholesalers would thus be able to realize a normal profit on the sale of the company's goods. They would buy direct from the manufacturer at the lowest price given to any outlet. Since the oil company already distributed all its products direct to the retailers, the plan would not increase the delivery expense.

Some members of the executive council, however, felt that the costs of direct sale would be prohibitive. Accounts would have to be kept for every small retailer and selling expense would increase, for company salesmen would have to call on both small and large accounts. Too, the matter of trade custom was a consideration. Many retailers did all their purchasing through wholesalers and did not favor buying direct from the manufacturer.

Under the third plan, the Greenfield Company would form a cooperative buying association to handle Greenfield products. Retailers who at present purchased Greenfield merchandise through jobbers and wholesalers would be privileged to join the association. The cooperative would make large volume purchases from the oil company and sell at low prices to its members. These retailers would then be better able to meet the prices charged the consumer for Greenfield products by retailers who bought direct from the manufacturer.

While the president of the corporation realized that the plan had its merits, he voiced the fear that the cooperative would become more and more a company organization, and that the Greenfield Company would eventually find itself in the position of selling direct to the member retailers.

Plan four was presented by a vice-president of the company. He proposed that the company fix the retail selling price for each product and make all retail outlets adhere to it. Both retailers buying direct and those buying through wholesalers would pay the same price for Greenfield products as they did under the present price policy of the concern. If the retailers who bought direct were not allowed to cut retail prices, the other distributors could make a normal profit on the products sold to the consumer and would carry the Greenfield merchandise.

The company had created a relatively steady demand for Greenfield products by extensive national advertising, and even though plan four would prevent retailers who bought direct from selling to the consumer at lower prices than other retail outlets, the vice-president believed that they would still carry Greenfield merchandise.

The controller of the corporation objected to any plan involving a fixed retail price. He pointed out that the purpose of the coming promotional campaign was to increase the number of retail outlets that carried Greenfield products, but that under plan four the company would not be able to sell to those retailers who would not agree to maintain fixed selling prices. This policy would limit the number of distributors, since some retailers resented any attempt on the part of the manufacturer to dictate the retail price at which his products were to be sold.

As a fifth plan, the controller proposed that the Greenfield Company manufacture two grades of each item produced. This was contrary to the firm's customary production program, under which only one grade of each product was put out. With such a plan in operation, however, the company would sell the high grade of each product to wholesalers and jobbers, and sell the low grade to chain stores and other retailers in a position to buy direct from the manufacturer. The company would sell both grades at the same price, but retail prices would be different. Retailers who bought direct would be able to sell Greenfield products at lower prices than other retail outlets, and therefore they would stock the company's goods. On the other hand, those retailers who bought through wholesalers and jobbers would sell a higher quality product to the consumer and thus could demand a higher retail price. The controller thought that plan five would satisfy both types of retailers.

The sales manager presented plan six to the president. It embodied substantially the same pricing policy then in use by the company. The oil company would continue to sell the products at the same price to large retailers buying direct, to service stations, to chain stores, and to wholesalers and jobbers. Only one grade of each product would be sold. To secure better distribution through those retailers who bought from wholesalers, the sales manager proposed that the company agree to take back its products if these distributors could not sell them at a fair price. Thus, if a retailer made a seasonable effort to sell a Greenfield product at a price allowing him a normal profit, and the goods did not move at this price, he could return the stock to the Greenfield Company without loss. The executive felt that most retailers would be able to sell the products at a good price, if they could once be persuaded to stock them.

The manager suggested that he himself form a price research department which would determine a fair retail price for each of the company's products for each geographical area in the United States. Such a price would take into account the delivery expenses, competition, and the usual margin received by retailers who bought from wholesalers. The prices thus set up would be revised from time to time to keep them in line with current conditions. All retailers who bought from wholesalers would be expected to adhere to the prices recommended if they wished to have the privilege of returning the Greenfield merchandise.

Which of the plans, if any, should the Greenfield Company have adopted for the sale of its household products?

"How much service shall we provide for our customers?" This is a question with which CPI managers frequently come to grips. The following selection relates how one large chemical firm, International Minerals and Chemicals, has answered the question for its Agricultural Chemicals Division.

In selling its fertilizers, IMC's management realized that there is little distinction among competing brands on such criteria as price and composition. But what then could IMC do to create a distinct image in the mind of the customer? Since the customer in this case is a professional buyer, an advertising campaign based upon contrived and exaggerated product differences would not do the job. IMC's answer to this dilemma is a comprehensive program of helping the customer in the day-to-day affairs of his business.

47

IMC Offers Customer Service to the Nth Degree

by Bud Reese

"Sounds to me as though IMC is some kind of an altruistic management consulting firm. . . . Of course, it makes a little money on the side selling agricultural chemicals."

This bit of waggery came from a Chicago adman after he heard Anthony E. Cascino, marketing vice-president of International Minerals & Chemical Corp., Skokie, Ill., tell a local ad club about the customer services offered by his company's Agricultural Chemicals Div.

The fact of the matter is that the wag wasn't far wrong about the management consulting; for the past three and one-half years the IMC division has been offering its customers a vast array of services, including counsel on just about every aspect of their business, from training salesmen to buying insurance.

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As for making "a little money on the side": Since the division announced its customer service program in mid-1958, annual sales have increased more than 20%. And according to IMC's 1959-60 annual report (the most recent available as of this writing), "The increase in net earnings from these operations was *the major* contributor to total corporate earnings" (corporate earnings for that fiscal year were up 21% to $7.5 million, on sales of $124 million).

And IMC marketing men, including president Thomas M. Ware, give much of the credit for the divisions's success to its customer service program. Their attitude is that the program gives the division a distinct competitive advantage.

Supply & Demand

The reason for the division's customer service program, which it has dubbed, "full orbit," dates back to about the mid-1950's. At that time existing seller's market was beginning to shift to a buyer's market, and IMC management realized that a more intensive marketing-sales effort would soon be required to hold on to the division's customers,—400-500 fertilizer manufacturers.

But, the division's products (phosphate minerals, phosphate chemicals and potash) offered little in the way of a strong competive advantage upon which to hang a sales pitch; the products were nearly identical, in quality and price, to those of major competitors.

In addition, IMC felt that the division's fertilizer manufacturer customers were not likely to be impressed with fancy sales pitches and elaborate promotional material. The typical customer company was, and still is, relatively small, serving dealers and farmers within a 50-mile radius; and the president of the average customer company is one-third of the sales force—along with being plant manager, traffic manager, advertising manager, etc. With all these jobs to do, he doesn't want to spend much time with lengthy sales talks or promotional copy.

IMC marketing management decided, therefore, to turn to customer service, on the theory that although products may be standardized, suppliers need not be.

Full Orbit Announced

The first phase of the division's customer service program was announced to the sales force in May, 1958, at a meeting in Chicago. At that time president Ware told the salesmen, "This is a new corporate way of life for IMC; all of our energies, talents and services are to be oriented to the benefit of the customer."

The salesmen were also told: "This full orbit program is a group of services specifically designed to assist the fertilizer manufacturer in the profitable execution of day-to-day operations. They cover a wide range of activities—market research, advertising and sales promotion, process development, technical service, sales management, transportation, and many others. They are free; this assistance doesn't cost a cent, or obligate the customer or prospect in any way."

Then, Phase I of full orbit was outlined and explained; it consisted primarily of:

1. More Management Consultation. Because of their small size, few of the division's customers could afford to hire specialists in, say, advertising and sales training; and occasionally a customer would write to the respective IMC department head for advice. But, IMC had not promoted this service; and as a result, many customers did not know of its availability.

Now, as part of full orbit, the division's salesmen were told to explain that IMC's specialized knowledge was "free for the asking." The division wanted all of its customers and prospects to know that it had "experts" on all aspects of running a business—advertising, sales management, traffic, production, accounting, purchasing, etc.—and that these specialists would help them with their problems. Most of the problems were to be answered by mail; or if the customer wished, he could arrange to visit IMC's specialists in Skokie; or, when necessary, IMC's "experts" would travel to the customer.

2. Better Organized Technical Service. The division had technical service men in the field long before May, 1958; but, these men were usually called in only in emergencies—on a "fire fighting" basis.

Now, under full orbit, the technical service staff would, if permitted by the customer, make regularly scheduled visits to the customer plant, locating potential trouble spots and making suggestions to head off expensive and irritating breakdowns. The division's salesmen were told to urge customers to take advantage of this service.

Along this same line, the technical service staff published a preventive maintenance checklist, covering 103 potential trouble spots.

In addition the technical staff was ready and willing to help with formulation problems, process development, plant reorganization, plant design, product development and training of personnel in new processes.

3. Expanded Transportation Service. About one-third of the average fertilizer manufacturer's selling cost is transportation. The IMC division's salesmen were told to explain to customers that IMC transportation experts were willing to help in these areas:

Routing assistance, advice on loading and transportation techniques, freight rate negotiation with carriers for the customer, plant and warehouse location studies, and handling of formal and informal complaints (if the carrier is at fault, IMC will file the claim for the customer; and very often, allow the customer credit, thus freeing his money).

In one ad on its transportation service, IMC stated that its traffic men represent customers in legislative discussions; carry their cases to legal bodies; and work for better rates and regulations.

4. Full Orbit Library. Also at the May, 1958, meeting, the salesmen were shown copies of six manuals, covering (1) advertising, (2) dealer meetings, (3) market analysis, (4) sales management, (5) technical service, and (6) transportation.

The latter two outline the expanded services available in their respective areas; the other four manuals were of the how-to type, covering the basic information a customer would need to advertise effectively; plan dealer sales meetings, etc.

The advertising manual, for example, covered the fundamentals of budgeting, selecting media, and planning ad strategy. This 88-page manual also contained information on the mechanics of preparing and placing advertisements, and a glossary of the most common advertising terms.

The manual on market analysis told the customer how to determine his total market and share of market, current sales trends by fertilizer grades, competitors' sales, his sales potential and sales goals. It also outlined and described the various sources of market information, i.e., government consumption reports and census data.

Customers Leery

The idea, at that time, was for the salesmen to devote the next call on each customer to explaining the over-all service program. Succeeding calls would be devoted to each of the six subjects, on a planned basis.

That didn't work. Few of the customers wanted the planned program, primarily, IMC frankly admits, because they were skeptical of the program's worth. They doubted that IMC personnel would be willing to spend enough time on any one of their problems to come up with any real assistance. They realized that the division, because of its size, had the specialized know-how, but they couldn't see any company taking any large amount of time to help customers without the usual strings attached.

IMC feels, however, that Phase I of the full orbit program was a success. Most of the customers were willing to accept some help in one or two of the areas covered by the program; and the manuals were, in general, well received. More important, Phase I laid the necessary groundwork for Phase II.

It "Clicks"

The second phase of full orbit began in January, 1959. During this phase IMC introduced the customer service which IMC feels "sold" the services already offered, and those still to come.

That service was sales training. In January and February of 1959, the Agricultural Chemicals Div. held 10 sales training clinics in as many cities around the country. About 350 customer salesmen (many of the 350 were salesmen-presidents of customer companies) attended the two-day meetings, at which IMC sales and sales training men explained the basics of selling.

All of the most up-to-date training aids were used—slides, movies, skits, role playing, etc. And little mention was made of IMC products.

Reaction, says IMC, was swift and gratifying. Many letters praising the clinics were received from customers—along with requests for more of the same. The result was a second series of clinics in the fall of 1959. This series drew almost 500 customer salesmen; and again, many were top executives.

Now the division's prospects and customers were beginning to be convinced that IMC was trying to help them with "the profitable execution of day to day operations." The division's salesmen received more requests for the full orbit manuals, and for information not covered in the manuals.

In response to the latter, the division made up loose-leaf binders, each containing 200 pages, for its salesmen. The binders contained abstracts of papers on some 50 fertilizer manufacturing and marketing topics. Copies of the papers were available upon request.

Two New Manuals

Also during Phase II, two new booklets were added to the orbit library, one on credit and collections, the other on insurance and safety.

Credit and Collections. This manual described the screening of credit risks, building prospect credit files, making credit decisions, collection practices and terms, etc.

Insurance and Safety. This 12-page booklet outlined and explained the dozen or so types of insurance of interest to a fertilizer manufacturer, and told him how to set up an effective safety program.

Both booklets also reminded customers and prospects that the IMC personnel in charge of these functions would be glad to answer any and all questions.

Planalyzer

Another important facet of full orbit was introduced at this time: The Planalyzer. This was a series of large wall calendars, each of which dealt with an important aspect of manufacturing or marketing fertilizer.

The purpose of the Planalyzer was to help the customer plan his year. For example, if the customer decided to have his advertising appear in early spring, before the planting season, the calendar would be filled out to tell him when to budget, when to began planning the ads, when to contact media, etc.

The sales management calendar was filled out to remind the customer when to review his sales manpower requirements, hold sales meetings, hold dealers' meetings, etc.

Production calendars, when completed, reminded the customer when to set cost standards, review labor requirements, order raw materials, schedule bagging operations, etc.

The Planalyzer calendars induced the customers to be more sophisticated in their planning and operation; and this, in turn, resulted in more requests for advice and assistance.

Educating IMC Sales

At this time, approximately June of 1959, full orbit hit a snag.

The complete service "package" was widely accepted, and IMC salesmen were being asked an increasing number and variety of questions. The "snag": the salesmen didn't know enough of the answers and were becoming bogged down with correspondence with home office "specialists."

Part of this problem resulted from the fact that, up until this time, the division's sales force was organized by products, namely, phosphate minerals, phosphate chemicals and potash. The phosphate salesmen didn't know enough about potash, and vice versa.

Also, some customers were being called upon by three different salesmen; and this, naturally, created confusion and duplications. Customers were willing to accept the complete customer service program, on a planned basis; but they wanted to work through one salesman, not two or three.

To solve this problem the IMC division's management began, on July 1, 1959, to call in the salesmen on a rotating basis. The salesmen were given more extensive training on the various aspects of making and selling fertilizer, and on the lines they had not previously handled. Sales territories were also realigned.

In addition, in September of 1959, the potash salesmen were sent to IMC's phosphate mines and chemical processing plants in Bartow, Fla., where they underwent a week of instruction by technical men and phosphate salesmen on the fine points of the phosphate products. Later, the potash salesmen went through a similar course at Carlsbad, N.M., where the company's potash mine and refinery are located.

With this and additional training (through sales bulletins) the salesmen became both liaison men and counselors. In some cases the salesman was able to provide all the help the customer needed, i.e., in putting on dealer sales meetings. In other cases the salesman performed the liaison function between customer and divisional specialists.

Phase IV

The fourth phase of the full orbit program, started in January of 1960, added two more services to those already offered. The two are IMC's traveling traffic team and its management seminars.

Traffic Team. During January, February and March of 1960 an eight-man traffic team, headed by Eugene Landis, IMC director of transportation, made the rounds of customer and prospect plants and asked "What's your traffic problem? How can we help?"

Mr. Landis explained that, in many instances, "faulty rates and faulty service have resulted simply because local freight agents were unfamiliar with certain commodity rates, volume rates, intermediate scheduling and other factors. Carriers want to charge the correct rate and offer the best service, but sometimes the smaller company hasn't the time or the personnel to call its problem to the attention of the carrier."

As a result of the traveling traffic team's efforts, IMC's customers and prospects have saved thousands of dollars.

This transportation service is still being offered on a limited basis, as requests for it come in from regional offices.

And to coincide with the program, the traffic department publishes a "transportation newsletter," containing information developed at rate hearings and industry meetings and from trade publications, boiled down and aimed specifically toward the plant food industry.

Management Seminars. In July of 1960 the IMC division held its first "fertilizer maangement seminar."

Top executives of customer and prospect companies were invited to Skokie for a three-day program which included instructions on organizational structure, financial management, profit planning, credit and collections, personnel development, public and community relations, industry trends, etc. Approximately 60 customer executives attended the seminar.

Textbook for the three-day school was a 454-page, hard-cover book titled, "Managing for Profit." The book, edited by IMC's marketing division, contained all of the material covered in the eight already-mentioned full orbit manuals, plus that of a new manual on accounting.

The new accounting manual, published about the same time as "Managing for Profit," covered "planned profits through accounting;" "making a profit plan;" "checking results against objectives;" and "reporting results against the profit plan."

Included were examples of the charts and statements needed to obtain decision-assisting information from accounting records.

"Managing for Profit" also contained a case history, described as follows in the textbook's preface; "Here is a complete portfolio of specific management information set forth in solutions to a typical fertilizer management situation . . . The approaches are worked out in a way that enables ready and easy application of the principles and methods to one's own particular problems. It contains step-by-step procedures, together with sample forms and visual examples . . . It demonstrates how you may analyze your own company."

One customer who attended the seminar described it as "Years of top management experience packed into three priceless days."

Additional proof of the acceptance of the seminar is the fact that 70 more customer and prospect executives showed up for the management seminar held in July of this year, and IMC expects to hold another seminar in '62.

Another Manual in '61

IMC introduced still another manual in time for the 1961 management seminar. The manual, titled "Purchasing for Profit," contains 44 pages of information on purchasing practices, administration, selecting suppliers, buying plant equipment, forms and record-keeping, and other purchasing topics.

And in addition to publishing this new manual, IMC has updated and expanded the information it provides on sales training and farmer meetings. It has increased the number of its sales management and training films to 16, and has revamped its Planalyzer to a more elaborate and useful "action calendar."

Results

Obviously, a customer service program of this magnitude is expensive. Has it been worth the cost?

The division's sales and profit figures have already been covered. Still more proof of the program's success is afforded by this quote from the 1959-60 annual report:

"Four out of ten customers for IMC fertilizer ingredients now buy the company's full line. A year ago only one customer in ten bought all these products from IMC . . .

"Looking to the future, the corporation is planning additional production facilities for high-concentrate phosphates. Meanwhile, IMC has entered into an agreement with Electric Reduction, Ltd., of Toronto, Canada, which will provide additional high-concentrate products . . .

"Sales volume of potash ran ahead of last year and despite record production it was necessary to buy substantial tonnage from other sources to meet our customers' needs . . ."

The "other sources" referred to in the preceding paragraph are, of course, competitors—and this in a buyer's market.

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